SPECIAL EDITION NO. 5
NOVEMBER, 1997
VOLUME 2

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WORKING WITH DUPLEX LOADS PART II

BY M.L. MCPHERSON

SYNOPSIS:

*Continuing studies of duplex loads reveal additional interesting results. Are duplex loads worthwhile to blackpowder silhouette shooters? **Part II** of this study suggests the answer might be yes. A definitive answer awaits accuracy testing in the 40-65 Falin (**Part III**).*

As noted in Part I of this series, in preparation for anticipated participation in a long-range black-powder competition in the summer of 1997, I set about to see if I could learn a bit about duplex loadings. A classic duplex load consists of a charge of blackpowder on top of a small charge of smokeless powder, a technique with a long tradition. I found the results of *Part I* of this study quite interesting. Those results suggested that duplex loads could reduce fouling considerably, compared to (singlex) FFg loads. *Part I* results also showed that simple blackpowder loads could deliver a level of ballistic consistency far superior to what many sophisticated modern smokeless shooters might expect!

I also learned that high nitroglycerin content (double-base) smokeless powders are a poor choice for duplexing with blackpowder — a logical result, combusting nitroglycerin is an oxygen scavenger. However, I lacked sufficient test information to suggest what burning rate of smokeless powder might provide the best duplexing results. *Part II* of this study suggests that those looking to minimize ballistic variation should look to middle of the road rifle powders for use in duplexing typical rifle loads (something in the 3031 range, perhaps). Equally, if fouling reduction is the primary criteria, one of the fast single-based shotshell powders is probably the best choice (Scott-1000 and Clays are likely candidates).

Rather than review *Part I* of the study here, I will simply include the most interesting data table from that study and explain how I performed that initial testing, since I gathered these *Part II* results in the same manner and my handloading followed the same protocol. Just as with *Part I* of this study, I believe the *Part II* results are interesting.

Before beginning Part II, I concluded Part I by firing an additional test load sample. This was a duplexing test using 5.0 grains of an experimental short-cut version of IMR-4895, which I will refer to as IMR-4895SC and that has superior metering qualities. I have included the results of that test in the Part I table, shown here.

All cases were match-prepped 45-70 Government, 186-grain (+/- 0.5-grain) R-P. In the *Part I* study, I used once-fired cases; in the *Part II* study I reused those, then, twice fired cases. In all tests, I used Federal 150 primers (standard large

Continued on next page

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Commonly used test components in this study: Lane commercial cast 405-grain 45-70 bullet from an original style (Lyman type) mould, GOEX FFg, fully prepped R-P case, Fed-150 primers.

Working with Duplex Loads

Continued

pistol), seated to slightly crush the pellet. For *Part I*, bullets were weight-selected 406.5-grain to 409.5-grain (nominal 405-grain) commercial-cast by Lane Bullets (now out of business, retired) for *Part II*, I used Lane bullets of 409.5-grain to 411.6-grain weight from the same production lot.

For all testing I loaded the ammunition using an RCBS Rockchucker press and RCBS dies. I also molybdenum disulfide-lubricated all case mouths with NECO's handy neck lube kit. Cartridge Over-all Length (OAL) was 2.658" for all loads. This exceeds SAAMI's maximum OAL for the 45-70 and precluded feeding these loads from the magazine of Marlin's new Model-1895. However, using this OAL limited bullet-to-rifling jump and that improved ballistic uniformity. I applied a heavy roll crimp. The neck expander button I used is 0.454" in diameter.

I carefully weighed all powder charges on my RCBS Powder Pro scale. I uniformly dumped those charges into the cases using the swirl-charging technique, as previously discussed in these pages.

The *Part I* study used duplex loads with each of six smokeless powders: *Scott-1000, Nitro-100, AA #2, AA #5, XMP5744* and a developmental short cut version of *IMR-4895*. I also tested standard (singlex?) loads using *GOEX's FFg* and *Cartridge Grade* powders. Each powder used in this testing came from one fresh can of that powder type.

In this *Part II* study I wanted to compare several types and burning speeds of smokeless powder using various duplexing charges with each powder. I chose IMR's SR4759 (single-base), Accurate's XMP5744 (double-base, 20% nitroglycerin) and Accurate's 2015BR (single-base) powders. The duplexing charges were 3 grains, 6 grains or 9 grains. These weights correspond to about 5%, 10% and 15% of the blackpowder charge used in each load.

I had two purposes in this *Part II* study. First, to test additional (slower burning) duplexing powders. Second, to see if I could determine an appropriate level of duplexing powder with regard to both fouling reduction and ballistic uniformity. These two, fouling reduction and ballistic uniformity, are not necessarily directly related phenomena. Unfortunately,

Part I, 45-70 duplex load study: 1895 Marlin, 22" fire lapped Barrel. Various loads: 405-grain Lane bullet, Fed-150 Primer. (See text for details of loading techniques.) Data based on 15-shot groups (excepting IMR-4895SC, which was 6 shots). Instrumental velocity at 15' (Oehler 35P, 6' screen spacing).

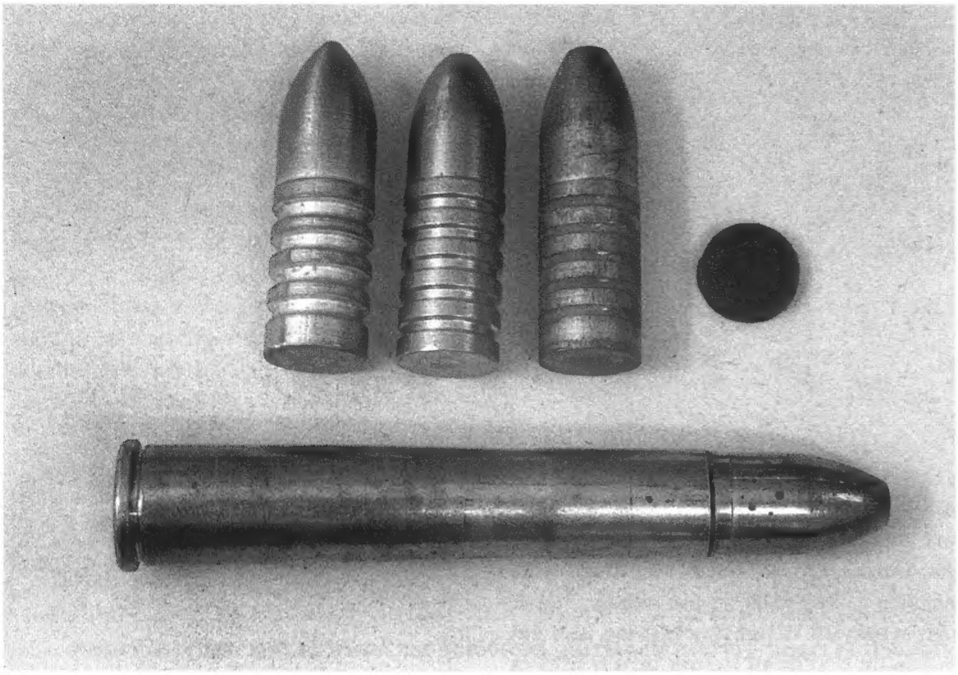
Duplexing Powder (@ 5.0 grains) **% Nitroglycerin**	**GOEX FFg Charge** (grains)	**Extreme Spread** fps	**Mean/ Std. Dev.** fps	**Relative Fouling** (1-10)
Scott-1000 | 0%	59.9	39	1249/11	1
Nitro-100 | 27%	60.3	35	1243/ 9	4
AA #2 | 24%	61.5	37	1272/10	3
AA #5 | 17%	62.5	26	1356/ 8	2
XMP5744 | 20%	62.0	23	1296/ 6.5	4
IMR-4895SC | 0%	62.0	13	1276/ 4	5
None	65.0	20	1204/ 6.2	8

Part II Duplexing Study Results, by duplex charge weight (see preceding table for load details):

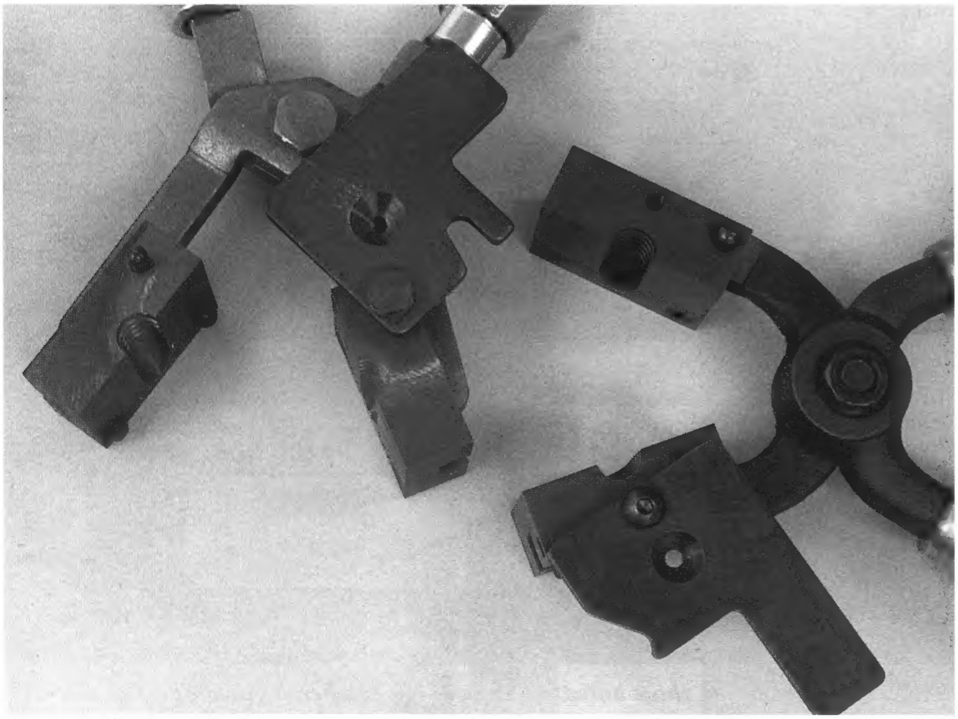
Duplexing Powder (grains)	**GOEX FFg Charge** (grains)	**Extreme Spread** fps	**Mean/ Std. Dev.** fps
XMP5744 @ 3.0	62.6	17	1262/ 5
IMR-4759 @ 3.0	63.2	23	1271/ 7
A 2015BR @ 3.0	63.2	24	1250/ 8
XMP5744 @ 6.0	60.2	21	1316/ 7
IMR-4759 @ 6.0	61.4	33	1341/ 9
A 2015BR @ 6.0	61.4	21	1299/ 7
XMP5744 @ 9.0	57.8	32	1362/12
IMR-4759 @ 9.0	59.6	18	1418/ 7
A 2015BR @ 9.0	59.6	21	1347/ 6
Smokeless Reference Load			
XMP5744 @27.5	- - -	26	1231/ 9

Part II Duplexing Study Results, by powder type (see preceding table for load details):

Duplexing Powder (grains)	**GOEX FFg Charge** (grains)	**Extreme Spread** fps	**Mean/ Std. Dev.** fps
XMP5744 @ 3.0	62.6	17	1262/ 5
XMP5744 @ 6.0	60.2	21	1316/ 7
XMP5744 @ 9.0	57.8	32	1362/12
IMR-4759 @ 3.0	63.2	23	1271/ 7
IMR-4759 @ 6.0	61.4	33	1341/ 9
IMR-4759 @ 9.0	59.6	18	1418/ 7
A 2015BR @ 3.0	63.2	24	1250/ 8
A 2015BR @ 6.0	61.4	21	1299/ 7
A 2015BR @ 9.0	59.6	21	1347/ 6



Top, left to right: RCBS 40-400-BPS, SAECO #740, RCBS 40-400-SP-CSA, NECO P-Wad. These 40-caliber cast bullets all weigh about 400 grains. Despite differences in appearances, all share a similar ballistic coefficient — surprisingly high at about 0.400. The differences in ogive cancel differences in meplat diameter, the sharper bullets have larger flats at the nose. Lower, 444 Falin cartridge loaded with the RCBS 40-400-SP-CSA. It seems likely the best long-range bullet for the various 40 caliber blackpowder chamberings would be about 450 grains. Such a bullet would have the same sectional density as the legendary 700-grain 50-caliber Sharps paper patch bullets. Launching such a bullet from a 40-65 class cartridge using FFg should generate less than 1100 fps muzzle velocity, which is desirable.



Lyman, RCBS, Redding and others offer 400-grain class 40-caliber moulds. RCBS offers two similar moulds of this size, which cast bullets of similar weight. The RCBS and Redding (SAECO) moulds shown here are top quality in design, materials and execution.

duplexing to reduce fouling generally increases ballistic variation; note the results with Scott-1000 in the *Part I* table, which was an exceedingly clean combination — the cases were cleaner than those fired with many smokeless loads I have tested!

A perusal of this data leads me to the conclusion that slower burning powders are a superior choice for those interested in creating **ballistically consistent** duplexed rifle loads. Further, generally, there does not appear to be any a *priori* basis for choosing a specific level of duplexing charge. Excepting the result with 9.0 grains of XMP5744, all of these standard deviation results are very impressive. There is little in these standard deviation numbers to suggest one combination over any other.

The extreme spread results are, however, quite different. For long-range shooting, the best loads are those that minimize extreme spread, even at the cost of a slight increase in standard deviation — better to have more of the shots near the top and bottom of a group with less total vertical stringing! In this regard, the 3-grain and 6-grain duplexing loads with XMP5744 and the 9-grain duplexing load with SR4759 are clearly superior choices. However, in this particular instance 2015BR is the over-all winner! In total, 2015BR produced less extreme spread. Further, it produced the least variation in velocity between the 3-grain and the 9-grain duplexing load. This suggests that 2015BR might be the sleeper among these powders.

This leads to a dilemma. For this application, the 3-grain XMP5744 combination would seem to have the advantage; it produced the lowest standard deviation, lowest extreme spread and launched the bullet very close to the lowest velocity of any combination (closest to the sonic barrier) — ideally, we want our bullets to start at 1100 fps or less. And, of course, for our anticipated application in the 40-65 with a 400-grain bullet, the results could be significantly different, compared to any results gathered in the 45-70. Therefore, this data suggests that, regarding the best-case ballistic uniformity combination, XMP5744 has an edge among these three powders. However, the limited results with the

Continued on next page

Working with Duplex Loads
Continued

developmental IMR-4895SC (see the above table) and the aforementioned good **over-all** consistency shown by 2015BR suggests that an even slower powder might have advantages. Good Grief! Will this testing never end?

With all three *Part II* test powders, increasing the duplexing charge reduced both smoke generation and fouling. A very subjective call is that SR-4759 was significantly superior in this regard. Considering the compressibility of this particular powder and the good results it generated, I expect I will try it first in the 40-65 loading. The trouble is though, at the 15% level (where it performed the most consistently here) it will likely develop entirely too much velocity in the 40-65-400 loading. Ballistically the worst thing a long-range black powder silhouette shooter can do is launch the bullet at about 1500 fps! Such a bullet will drop below the sonic barrier at about 300 yards, where it will be dropping quite fast. That combination of factors can destabilize the bullet. This is the same thing the 308 Winchester Palma competitors see when their bullets don't stay supersonic to the 1000 yard target — such bullets often tumble.

This brings up another point — bullet weight. I suspect that what we need in the 40-65 is a bullet exceeding one-ounce — closer to 470 grains than to 400 grains. Use of such a bullet should keep most reasonable duplex loads at subsonic muzzle velocities. Time and more experimenting will tell. I might include that testing in the *Part III* study.

Many pertinent things are not yet clear

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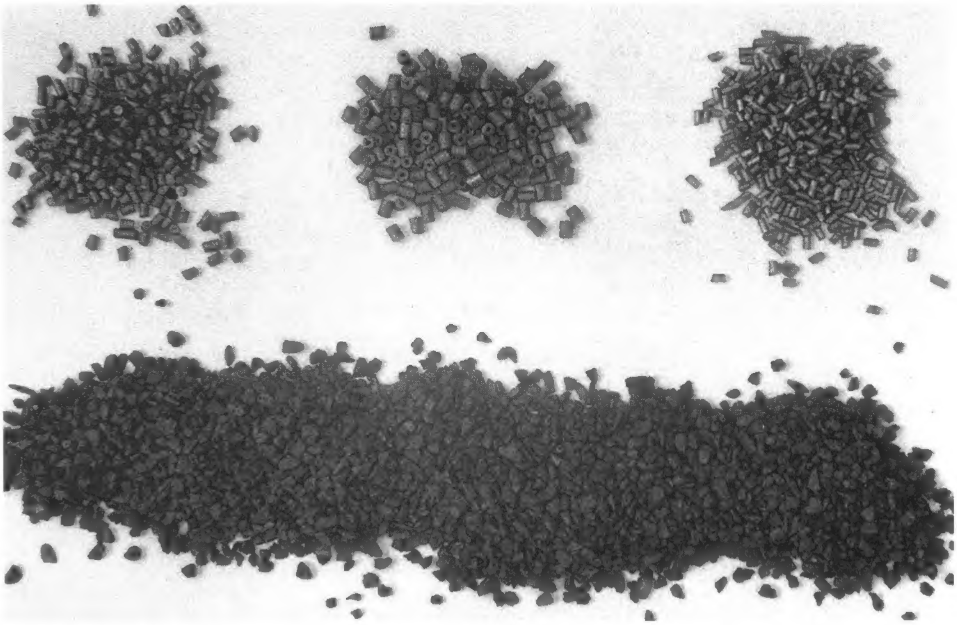
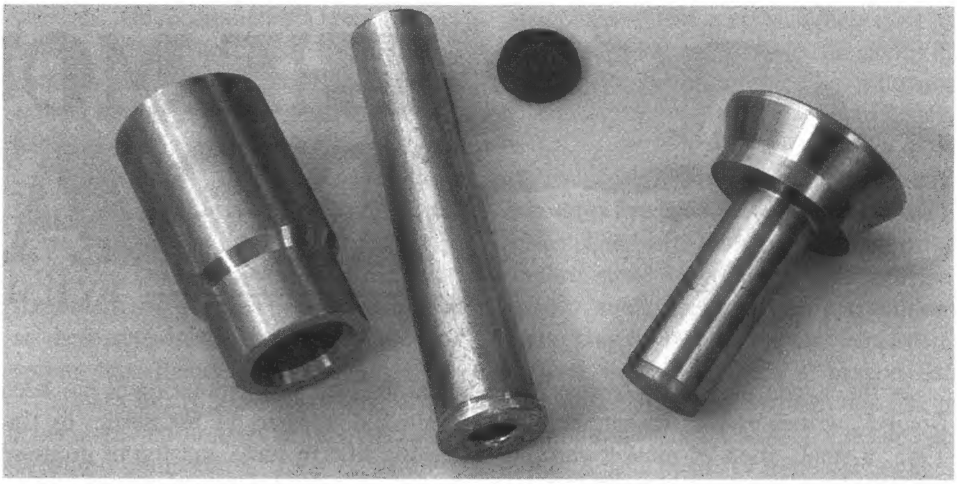


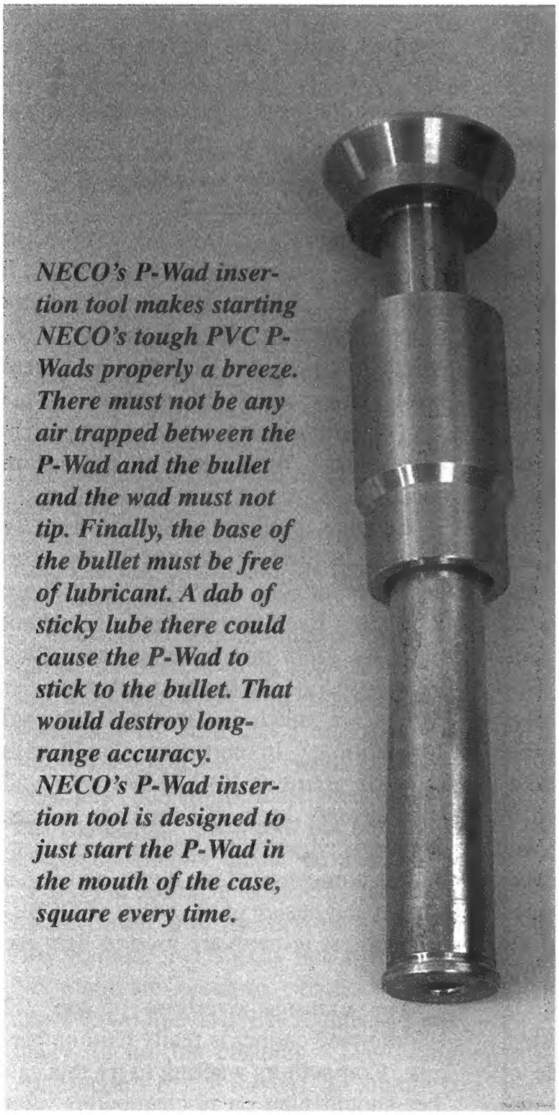
Top, left to right: Various duplexing combinations tested in this study: Accurate XMP5744 (double-base, 20% nitroglycerin), IMR-SR4759 (single-base) and Accurate 2015BR (single-base). Lower, GOEX FFg. While single-base powders seem to reduce fouling more than double-base powders, one combination of GOEX FFg and Accurate XMP5744 managed 5 fps standard deviation with an extreme spread of only 17 fps. Even accounting for the modest muzzle velocity of these loads, this is impressive uniformity.

RCBS makes it easy to shoot antique and custom-chambered guns. The dies marked 40-65 Special form 444 Marlin cases with a long cylindrical neck and a straight taper to the base, a cartridge designed by Mr. Bill Falin, Accurate Arms Chief ballistician. This design supports long bullets better than a shorter necked straight-taper case such as the 40-65 Winchester.

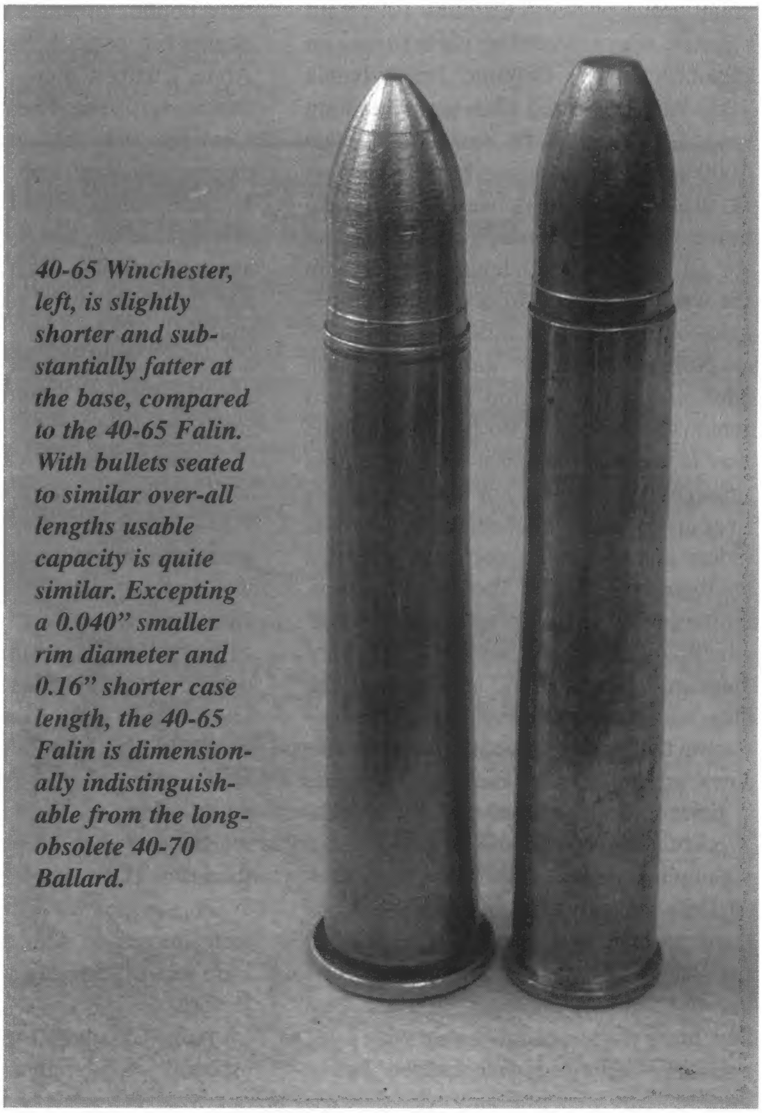
to me. However, one thing is quite clear: I do not know enough about duplexing loads to even guess if this method promises a benefit in long-range shooting in cartridges such as the 40-65. Next Spring I hope to do some 300-yard target shooting with the Sharps (actually the Four Corners range only has 280 yards, but that is sufficient). The results of that study will have a lot to do with any decision to use a duplexing load and what combination and charge level that might be. Meanwhile, I will probably test bullets cast in at least three similar bullet molds and maybe even with several different alloys. Then there is the issue of using P Wads. After all, as we all know: To **P** or not to **P**, that is the question.



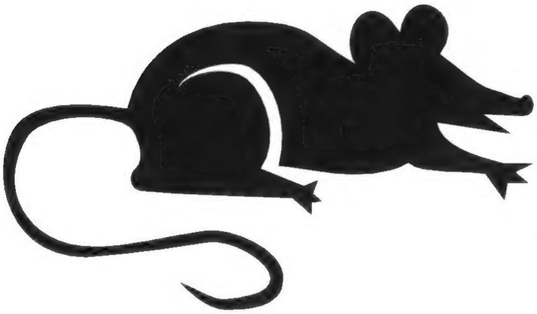
I expect to try NECO's P-wads in upcoming accuracy tests in a C. Sharps rifle chambered in 40-65 Falin. In many instances, P-Wads are beneficial when shooting blackpowder. These PVC disks can scrape fouling from the bore, seal the base of the bullet against hot powder gasses (thereby limiting lead cutting), improve bore sealing and prevent soft bullet lubricant from infiltrating the powder column. NECO's P-Wad starter makes loading a bit easier and, for those working with large batches of cases, is a worthwhile investment.



NECO's P-Wad insertion tool makes starting NECO's tough PVC P-Wads properly a breeze. There must not be any air trapped between the P-Wad and the bullet and the wad must not tip. Finally, the base of the bullet must be free of lubricant. A dab of sticky lube there could cause the P-Wad to stick to the bullet. That would destroy long-range accuracy. NECO's P-Wad insertion tool is designed to just start the P-Wad in the mouth of the case, square every time.



40-65 Winchester, left, is slightly shorter and substantially fatter at the base, compared to the 40-65 Falin. With bullets seated to similar over-all lengths usable capacity is quite similar. Excepting a 0.040" smaller rim diameter and 0.16" shorter case length, the 40-65 Falin is dimensionally indistinguishable from the long-obsolete 40-70 Ballard.



THE MOUSE THAT ROARED!

BY D.M. FRANKLIN

In the screen play *"The Mouse That Roared*", written by Christopher Sergel in 1963, a small troop of musket carrying soldiers from a tiny country in western Europe traversed the Atlantic ocean and boldly sailed their masted ships into New York harbor. The objective of this tenacious little army was to capture an atomic bomb on display in the Empire State building, return it to their homeland, and hold the world hostage until it agreed to peace— and that they did! Such swashbuckling style was similar to that of a small group of North Carolina 1000 yard shooters who ventured up north to take on members of the Original Pennsylvania 1000 Yard Benchrest Club and other long range shooters at the first world open 1000 yard benchrest match. The mission of the Carolina boys was simple, take home the championships and once and for all establish their legitimate place in the world of 1000 yard benchrest competition— and that they did!

North Carolina native Brandon McNeil, one of the top IBS 1000 yard junior shooters, took no prisoners on his way to winning the world open 1000 yard group championship. His ten shot groups averaged 8.354 inches, showing his elders that you better not mess with this southern boy. David Tooley, noted gunsmith and secretary/treasurer of the IBS sanctioned North Carolina 1000 Yard Benchrest Association, also carried the flag, winning the score aggregate championship by finishing second in score to fellow Carolinian Jamie Cass, who won the entire match and earned the title of 1996 World Open 1000 yard Benchrest Grand Champion.

Cass not only led this merry band of southern marksman in triumph, but set the 1000 yard benchrest community of its ear by winning the over-all 1000 yard benchrest world championship with a .22 caliber Middlestead chambered heavy gun. Facing overwhelming odds, Cass and his little pea shooter (as it has been called) dominated the big thirties by finishing first in score and fourth in group over the two days of competition. In such windy conditions, no one could believe that such a small caliber could shoot an average score of 96.00 along with a ten group average of an equally impressive 9.128 inches.

Who is this man who would dare to become king! Just like the caliber of his rifle, Jamie Cass is a very unusual person. His general appearance of two hundred fifty pounds of muscle packed into blue denim bib overalls reminds me of "Lil Abner" with a gun— but looks can be deceiving. The twenty eight year old Cass not only has earned a bachelor's degree in electrical engineering from North Carolina State University, but also a computer engineering degree from the same university. Cass and his dad manage their own very successful high-tech machine shop in Danbury, North Carolina. Better think twice before challenging Cass in long range shooting or intellectual prowess.

Given, Cass is a very smart man, but why did he decide to build a .22 caliber 1000 yard benchrest rifle. About four years ago, his second cousin, Steve Cass, was looking through a book of wildcat cartridges when he came across the .22 caliber Middlestead that had been developed by Paul Middlestead between 1964 and 1965. Steve thought this caliber would be a unique, but efficient chamber for long range varmint hunting and decided to ask Jamie if he was interested in working on such an idea. A reamer was found and the project was conceived. When the gun was completed, both men were impressed with the accuracy of the little cartridge and the flatness of the trajectory.

Jamie Cass has always loved shooting, especially long range. Maybe some of our avid PS readers can remember the picture a few years ago of Jamie standing with his .22 caliber barreled action bolted to a wooden two by four that he used to place at the infamous Hickory Egg Shoot. John Seamon's 1000 yard field shoots became the perfect venue for Cass to test his skills with the little .22 caliber. Not only did the Middlestead work well in these early long range matches, but Cass was immediately hooked on 1000 yard benchrest competition. Over the next couple of years, Steve and Jamie Cass would prove that you do not have to shoot big calibers with lots of powder and two hundred grains plus bullets to compete and win in 1000 yard competition. Winning the world open championship at Williamsport was truly a crowning accomplishment for Cass and his little .22 Middlestead cartridge.

So what is a .22 Middlestead? Cass takes .243 Winchester brass and necks it down to .22 caliber. It is then blown out to match the thirty degree shoulder of the Middlestead design. Cass then neck sizes his brass for match competition. Jamie says other brass may work, he just prefers Winchester. Who wants to argue with success?

Cass has found the Middlestead can be a finicky caliber. Bullet weight and powder selection are critical to long range accuracy. Even though Jamie can shoot fifty-five grain match bullets near 4200 feet per second, he has found that heavier bullets are much better for 1000 yard competition. In particular, Jamie says forty-six grains of IMR 7828 works well with seventy grain JLK custom bullets. The reduced velocity, 3638 feet per second, is compensated for by the additional weight and design of the bullet. CCI BR-2 benchrest primers are used to light the load.

The extreme overbore of the .22 Middlestead caliber is really hard on barrels. Competitors wanting to try this caliber should plan on re-chambering after five hundred rounds. After seven hundred rounds, most barrels are finished— at least by benchrest standards. Cass does his own gunsmithing; that helps him keep his guns sharp.

As for barrels, Cass believes the longer the better. He prefers Lilja barrels even though at this time Dan (Lilja) does not make .22 caliber barrels longer than thirty inches. Cass has also had good luck with very long Krieger barrels. Regardless of the barrel manufacture, Cass says just chamber the barrel in .22 Middlestead, fit it to most any action, and properly bed it in a benchrest stock, then go elephant hunting for those big thirties.

The custom one hundred pound Middlestead chambered heavy gun Cass used to win the world open title features a Hall G action, 1.438 inch diameter Lilja barrel, and a Jewell trigger. A six inch stainless steel barrel block is bedded in a unlimited Six Enterprises heavy benchrest stock, leaving the remaining Lilja barrel and the Hall G action free floated. At the time Cass won the world open title he was using a thirty six power Tasco scope on the rifle. He won a new twelve to forty-two power Nightforce scope with his title at the open and has since installed it on his gun. Cass feels either scope provides excellent optics for 1000 yard benchrest competition.

The gun is stabilized by a twelve inch wide, eight inch long front plate that rides on sand bags affixed to the top of two home made front pillows on a heavy rest plate. Cass also made his own mechanical rear rest that guides the butt stock. The gun tracks great and requires few, if any, aiming adjustments in a ten shot record string. This helps explain how Cass can single load and fire ten shots in about twenty seconds.

There is no question that Jamie's .22 caliber guns shoot great and are consistent winners in 1000 yard competition. I want to make sure that I establish that before I tell you how he cleans his rifles. Benchrest gunsmiths may want to skip this paragraph. Cass does not believe in excess cleaning— that is an understatement! For example, a new barrel is not cleaned until after the first two-hundred fifty rounds. No, this is not a misprint. No elaborate break-in procedure, just shoot it two-hundred fifty rounds and it is ready for its first cleaning. Then, only use Hoppe's No. 9 solvent, no ammonia solvents. He recommends a few light wet strokes with a phosphorus bronze brush coated with Hoppe's initially, followed by several Hoppe's soaked patches. The wet patch application continues until all the carbon fouling is removed. Cass says sometimes it may take several days. After that, he continues to use the same procedure, but now cleans his rifles more frequently, say after every one hundred or so more rounds. So much for the every twenty shots theory.

Jamie Cass is considered one of the most respected shooters in IBS 1000 yard benchrest competition. Like E.F.Hutton, when Jamie speaks, people listen. He is as comfortable at a shooting bench as he is behind a computer. Cass is a very mild spoken young man— a real gentleman. When I asked him about his success, he simply replied, "Heck, I guess it's just luck". I can assure you it is more than luck. Cass is highly intelligent, an excellent shooter, a meticulous hand loader and quality machinist. You better believe, his guns are right!

There is one advantage that small caliber rifles seem to have over the large magnums— less recoil. When coupled with a rapid shooting style, the ability to maintain the same aiming point following light recoil and minimal return to battery can be a significant advantage in 1000 yard benchrest competition. Remember, ten shots fired in twenty seconds. Cass is often finished with his second string before some competitors hardly begin. And I don't think in windy conditions those tiny bullets get blown everywhere. Just as in Williamsport, at several IBS sanctioned 1000 yard matches this year in Virginia and North Carolina, Cass and his little .22 sent plenty of thirty caliber boys home wondering what happened and talking to themselves.

If you would like to know more about using the .22 Middlestead for long range hunting or 1000 yard benchrest competition, just give Jamie a call between 9PM and 11 PM EST at (910)593-8768. But remember, you're talking to the 1996 World Open 1000 Benchrest Grand Champion who owns the mouse that roared!

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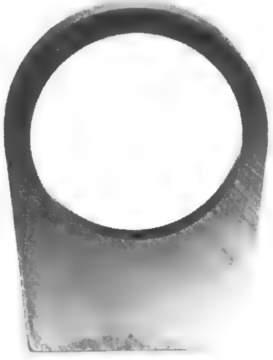

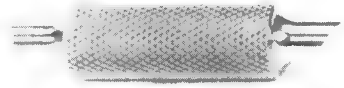

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INEXPENSIVE O-RINGS CAN IMPROVE YOUR LOADS!

BY M.L. MCPHERSON

Synopsis: *Dies might not align with the ram when simply screwed into the press. This can result in a cartridge body that is not square with the case head. Also, often, the sizing die decapper /expander stem in standard dies is misaligned with the centerline of the sizing die. Equally, the bullet seating stem might not naturally center in the die body. Both of these problems can potentially bend case necks out of alignment. Fortunately one can easily and inexpensively solve all of these problems.*

One of the major problems limiting the quality of handloads is cartridge straightness. Obviously, a cartridge that is not straight is unlikely to align the bullet with the bore. A misaligned bullet might not enter the bore squarely. Such a situation cannot contribute to accuracy. Equally, if the sizing die body does not spontaneously aligned with the press's ram, the head of the resized case might not be square with the case body. Chambering such a case results in a situation where the case head contacts only one side of the bolt face. This cannot contribute to accuracy either!

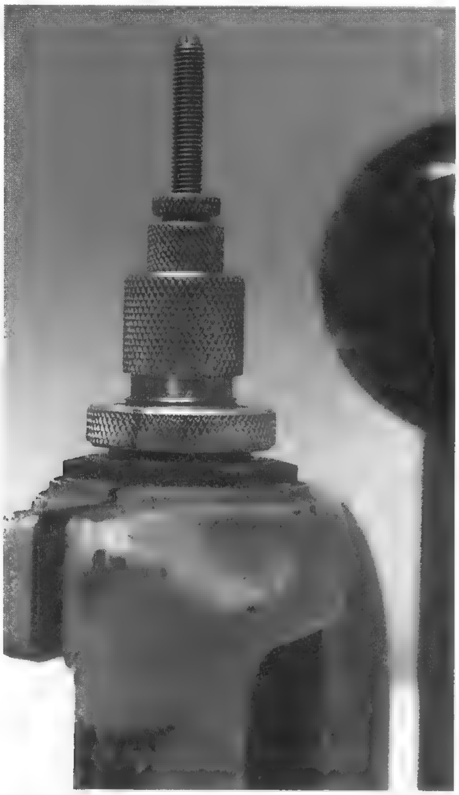
Fortunately, one can alleviate all of these problems and make one's dies easier to use by the simple expedient of installing O-Rings where appropriate. In the instance of the die bodies, an inexpensive and handy solution is to install Lee's O-Ring equipped, self-locking die body locking rings.

As a measure of the value of this conversion, Lee has sold over three thousand of these $1.50 rings in the last 10 months. All were purchased by handloaders who substitute these for the original locking ring on other brands of threaded dies. Likely, most folks make this conversion because these rings make die changes quicker and easier. However, the fact that these lock rings leave the die body free to float, and thereby more apt to properly center and align with the ram, suggests there is a better reason. (This assumes one does not over-tighten the ring, which limits or eliminates these benefits.)

For only a few pennies, one can simply install the correct size O-Ring between the press and the existing locking ring to accomplish improved alignment and centering. I use an O-Ring that rolls up over the die body tight enough so that it stays in place when one removes the die from the press. Of course, one will need to adjust the lock ring appropriately higher on the die body to accommodate the thickness of the installed O-Ring. Also, do not over-tighten against the O-Ring; this limits the benefit. I only tighten the die body enough so that it does not spontaneously unscrew during use.

This is a useful modification for all screw-in dies. This approach might be most beneficial with dies or presses of questionable quality and in presses that can differentially flex under stress, as is

Here we see the Lee Lock Ring complete with O-Ring.



Here is a standard RCBS die with an O-Ring installed between the press and the lock ring.

typical of the "C" type press. Nevertheless, even with a perfect die used in a perfect press, use of an interposing O-Ring cannot hurt. . .

A similar problem crops up in sizing dies that feature a neck-expander button, as is typical of all standard screw-in dies. Very often the expander does not perfectly align with the die body. When one withdraws a resized case from such a die, the expander stem has to flex or the case body has to tip to allow the expander to pass through the case neck. If misalignment is sufficient, the expander might bend the case neck as a result of the differential stress this action imposes.

Installation of an O-Ring between the expander stem carrier bushing and the expander stem locking nut allows the expander stem to "float" and therefore easily center in the die. Again, choose an O-Ring that is small enough to fit tightly around the stem and do not tighten the locking nut excessively. The stem will still center adequately so that the decapper will properly enter the flash hole. It will realign very easily to center the expander button in the case neck. This minimizes differential stress on the case neck and shoulder.

Similarly, the bullet seating stem might not normally center perfectly in the seating die body. When the bullet impinges against the stem the bullet will

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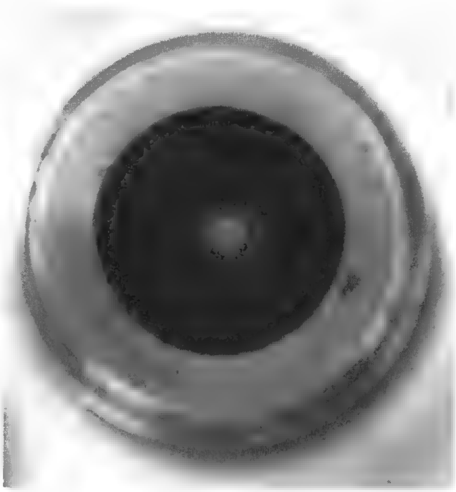

Shown is a particularly bad example. This 6mm Remington Full-length sizing die normally aligns the expander stem visibly off-center.

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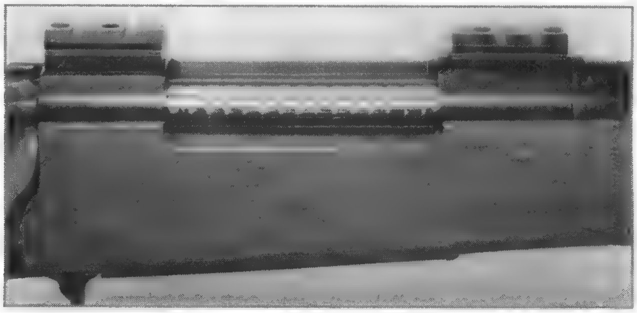
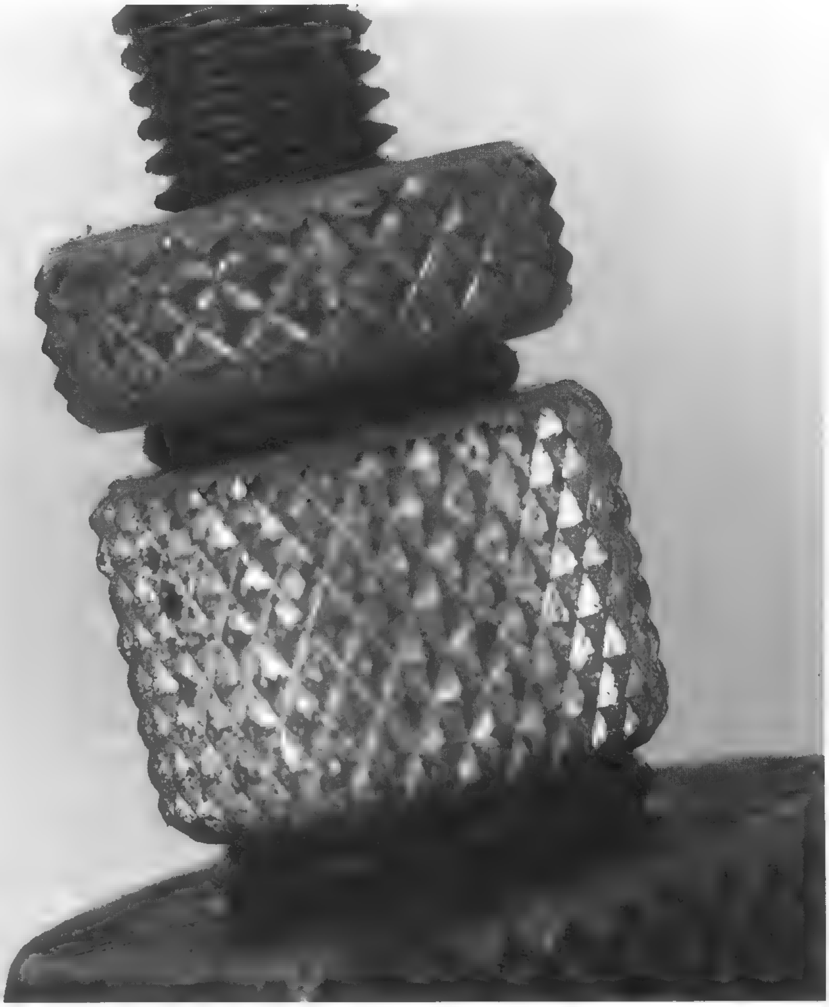


Inexpensive O-Rings

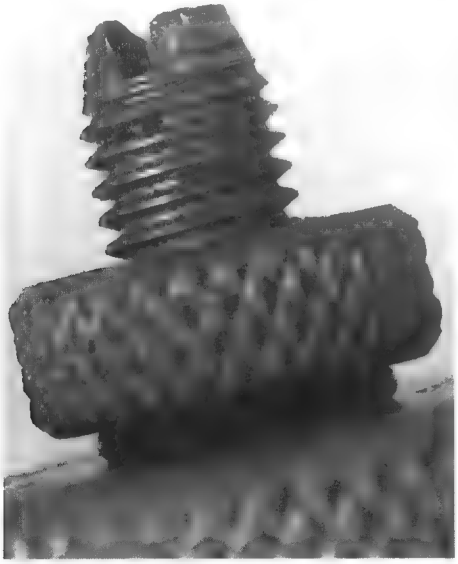
Continued

center in the stem. If the stem does not properly align with the die body something will have to give, the typical result is a bent case neck. The simple installation of an O-Ring between the bullet seating stem locking nut and the die body allows the seating stem to align to the case body.

These "modifications" are so inexpensive and simple that one is tempted to suspect that they, "just must not be worthwhile." Do not be so misled! If your dies and press are perfect and all the threads in the press, on the die body and on both the bullet seating stem and the decapper/expander stem and all of the associated nuts and bushings are both perfectly clean and perfectly formed, then perhaps there would be no potential accuracy advantage to using O-Rings! For myself, I will happily spend the few pennies to use O-Rings since these might improve my handloads and they definitely do make it easier to install and adjust these dies.



Here is a very old RCBS die with particularly bad alignment in the expander/decapper stem assembly. I have installed O-Rings both between the stem bushing and the die body and between the stem bushing and the stem locking nut. This maximizes the amount the stem can easily realign to properly center in the case as the expander button expands the case neck.



Here I have installed an O-Ring between the bullet seating stem lock nut and the die body. With the nut properly tightened, I can adjust bullet seating depth by turning the stem with my fingers. . . "Look mom, no tools!"

A collection of O-Rings with die parts. A simple modification of the basic plan that can lead to dramatic improvements in handloaded ammunition.

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BY JOHN M. ECKENRODE

Dedicated to Charles W. Simpson
"Charlie"

I cannot begin to say enough for this man whom I met purely by chance, and was responsible for bringing me into the world of "Accuracy" shooting. Charlie took me under his wing while I was a complete stranger to him, seventeen years old and still recoiling from the sudden loss of my father, and channeled the energies of a young, inquisitive mind into looking beyond the comfortable bounds of the "plinking" fraternity. In this journey that started with an evening "project" of making some 2R Lovell cases, and the accompanying trip to the range to taste the fruit of our labor, he has encouraged and supported me through many, and varied, shooting endeavors. With a humble start as his "gunbearer" for local Hunter Class Matches and willing loading bench assistant, his continued enthusiasm and support carried me through competing along side of him, and into the world of Service Rifle Competition. Charlie's selfless interest in the shooting sports and the plight of a somewhat lost young man enabled me to earn an unmistakable icon of Marksmanship Excellence: A position on the United States Marine Corps Reserve Rifle Team. Though our lives at times seem to have grown apart, for this Charlie, I will always be indebted to you.

With the renewed interest in the .17 and .22 calibers (especially) for "hyper" velocity cartridges and experimentation in general, I can't help but think back to a statement that my father made to me many years ago to the effect that nothing *really* new had been invented in the firearms world in almost 100 years: while technology as a rule is constantly improving, new products and "breakthroughs" are merely ideas and methods (or a combination thereof) that are "reinvented", "rediscovered", or remarketed by different folks periodically (with varying degrees of commercial success, I might add). Some of the "brilliant discoveries" by various inventors in the past have failed commercially because manufacturing capabilities of the time couldn't support their needs. An good example here is the semiautomatic rifle: Well over a hundred years ago, several inventors (Jonathan Browning among them) experimented with modified rifles that were "self firing" (gas operated). The projects as a whole were ultimately abandoned because, among other things, they had terrible fouling problems: smokeless powder had not yet been invented. Once smokeless powder came about, these ideas again resurfaced, and the rest is history.

Likewise, various wildcat cartridges (and their domesticated, factory chambered relatives) purported by some in the past as uselessly overbore have seen with a renewed interest both afield and here in the pages of PS, thanks to recent developments in "Low Drag", or "Heavy" bullet designs. Those who take the time to read, cover to cover, books such as Phil Sharpe's "Complete Guide to Handloading," (An outstanding book published originally by Funk & Wagnall's in 1937, and reprinted in 1941, 1949, and 1952, respectively) will be surprised at the long lineage of some of our current star performers.

One such performer, the .220 Swift, made world-wide news with its introduction by Winchester in April of 1935. The new "King of the Hill" provided a factory chambered rifle and load purported to develop 4100 f.p.s. with a 48 grain bullet. What didn't make the news, however was the fact that it was unseated just 2 years later by some quiet experiments at Springfield Armory. If that doesn't grab your attention, how about this little detail: Springfield Armory's bullets went into the chamber as a .30 caliber, but exited the muzzle a .22!

Up into the 1950's, Springfield Armory was a small arms test and evaluation, development, and production center, with no equal to be found around the world. It had the resources, both in manufacturing/testing equipment and qualified, skilled personnel, to ensure that the fighting men of this nation could be supplied with the best small arms and associated equipment possible. It was, after all, instrumental in the development, testing, and (*debugging*) of the M1 Garand - claimed by many to be the greatest military rifle of all time.

After "The Great War" (World War I) Springfield Armory cultivated the M1903 rifle and .30 Caliber M1906 cartridge into the premier bolt action military rifle/cartridge combination in the world - bar none. Well known is the fact that the action is based on Paul Mauser's 1898 design, "borrowing" some of the finer points of Mr. Mauser's design, and that the resemblance of the .30 M1906 cartridge to Germany's 7.9X57mm is no coincidence. A little less well known is that a few years later we borrowed some more technology from the Germans in the form of a projectile designed by a Mr. Puff, from Spandau.

On page 444 of Lt. Col. Brophy's Book, "The Springfield 1903 Rifles", Brophy makes a brief mention of what he calls the "Puff Bullet Rifle", an experimental flanged bullet/tapered bore cartridge and rifle combination. Brophy goes on to mention two of the foremost

Continued on page 18

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Springfield Armory
Continued

inventors of high velocity rifle bullets as M.H. Gerlich of Kiel, Germany, and Carl Puff from Spandau. Brophy mentions that the Springfield Armory Collection contains a Model 1903 rifle, SN 35884 that has a tapered bore chambered for the "Puff" bullet. The bore of this example is .3386 inch at the breech and .308 inch at the muzzle. Page 444 of Brophy's book also features a photograph of the barrel marking on this rifle, marked "SA" with the barrel date (2-09) in the normal fashion on top of the barrel between the bayonet lug and front sight, below which is found the marking "Puff bullet".

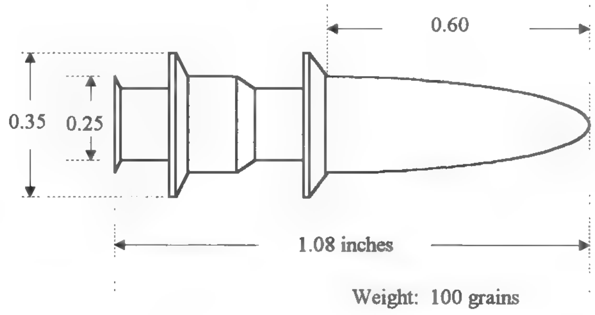
As a historian, I found it interesting that regarding the tapered bore, ultra-high velocity experiments, Mr. Brophy states "Mr. Puff's tapered bore was probably the most important step in that direction". My research, however, based on writers and experimenters of the period do not even make mention of Mr. Puff, but instead refer to the projectile as the "Gerlich" projectile. Based on the barrel date on the specimen in the Springfield Armory collection, my personal theory leads me to believe that Mr. Gerlich either "picked up the ball", or "re-discovered" the tapered bore concept some 25 or so years after it had already been abandoned once by Springfield Armory. The only information I have been able to find regarding the Puff bullet is Brophy s mention of Springfield Armory accession information noting that accuracy of the Puff bullet rifle was so poor that the project was abandoned. No further information had been found indicating velocities obtained with the Puff rifle, either claimed or actual, or even if this was considered the only unique feature of this rifle!

Mr. Gerlich was a noted German ballistic engineer and experimenter, who is probably more well known for his contribution to the high intensity Halger rifles and cartridges developed prior to World War Two. Mr. Gerlich entered the tapered-bore velocity race with a further reduction from Puff's projectile to a terminal bore diameter of .25. Mr. Gerlich's projectile, Illustrated in Figure #1 began life as a .35 caliber, and ended as (approximately) a .25. The Gerlich high-velocity tapered bore rifle barrel used a .33 inch throat to start the projectile into a non-tapered 5.27 inch section of barrel. After leaving this section, the bullet enters a 6" tapered section where the bore diameter is reduced from .344 to .244, with a .250 groove diameter. The final 12 inches of the barrel is non-tapered at .244 diameter, and is rifled 1 turn in 8 inches throughout, with a right hand twist.

Mr. Gerlich was unable to find any interest in the German military establishment, or the any other European nations, and came to the U.S. Gerlich had apparently received patents for his new projectile, and this is how Springfield Armory first got wind of his development. The Army showed a great deal of interest in his claims, and in 1932 hosted Gerlich at Frankford Arsenal for testing, where his provided rifles and ammunition were evaluated. The Army was considering purchasing Gerlich's patent rights, until their experiments showed that Gerlich's velocity claims of excess than 6500 f.p.s. were unattainable. U.S. test results, with provided original guns and ammunition, only showed velocities in the 4500 f.p.s. range. What is clear however, is the fact that Gerlich s hyper velocity work generated some real interest in the Army, and they did not want to be left out of the "velocity race." Over at Springfield Armory, their ballistic engineers, tool and die makers, and associated personnel rolled up their sleeves and went right to work.

The Army spent four years trying to better their initial results, with no luck. The Army's first experiments used a bullet of the same configuration as the Gerlich, but with the terminal caliber further reduced to .30-.22, for a projectile weight in excess of 60 grains. Velocity results, however, continued to linger in the 4500 f.p.s. range, along the same lines as the earlier Gerlich bullet. In these early experiments, Springfield Armory was still unable to even approach the velocity claims of the Gerlich projectile, both with the German test gun and ammunition provided, and with guns and ammunition specially developed and loaded by Springfield Armory. Howe notes that in this period, Springfield Armory spent almost $40,000 on producing barrels for these tests. Even Hercules and Dupont had been called in to manufacture experimental powder in an attempt to reach Gerlich's claimed velocities. Frankford Arsenal was responsible for the special projectiles and loaded ammunition of these early tests.

By this time, Gerlich's work had apparently become fairly well known to the more knowledgeable shooters and experimenters of the time, as Phil Sharpe makes mention of his projectile and velocity claims in his 1937 work "Complete Guide to Handloading." Both Mr. Sharpe and Mr. Howe evidently stayed in close contact with each other, as Sharpe makes mentions of Howe s efforts as this book is going to print , and also stated "Details of the experimental work are an Army secret at the present time." James Howe wrote in Chapter VI of a later supplement to his book "The Modern Gunsmith" (first printed by Funk & Wagnall's in 1934, and an excellent reader, worthy of a place on any gun enthusiasts or gunsmith's shelf) that on January 2, 1937 he accepted a position at Springfield Armory to work on a high



Gerlich's .35-.25 Two-Diameter Bullet

Figure 1

velocity gun and ammunition project. His instructions were to "attack the problem from a different angle than that specified in Gerlich's patents, and secure, if possible, the velocities which Gerlich anticipated".

Initial results showed that Howe was able to turn the experiment around. Sharpe mentions in his "Compete Guide to Handloading" that on February 12, 1937 Howe fired a test string producing velocities of 5122 f.p.s. An additional (single) shot registered 7100 f.p.s.! Sharpe reported that he had the cartridge case from the round which registered the 7100 f.p.s. velocity in his personal collection, and it showed "no signs of excessive pressure." Sharpe went on to say "At the time of going to press[1], Howe and his assistants had recorded a velocity between 8500 and 9000 f.s. (sic) - the highest in the world". Howe personally related to Sharpe that he believed there would be no problem in achieving velocity of 10,000 f.p.s., as these high velocities already attained were "achieved with normal Springfield pressures." I should point out here that James Howe, in the course of only 6 weeks, had bested Springfield Armory's work over the course of the previous 5 years!

In order to obtain these increased velocities, Howe further reduced the weight of the projectile by removing the rearmost gas-sealing fin. The elimination of this fin further reduced the weight of this projectile to 45 grains. Howe's bullet is illustrated in Figure 2. Howe's projectiles were turned individually by hand on a bench lathe from a copper-nickel alloy, probably onsite at Springfield Armory. The cartridges themselves appear to have been loaded individually from military .30 brass (probably Frankfurt Arsenal) for this effort. Unfortunately, none of these Howe projectiles, or loaded cartridges are known to exist.

Through the course of his experiments, Howe ran into some interesting technological obstacles. The chronographs of the period were not providing a high level of reliability with the velocities ranges obtained in testing. Howe fired several shots into the screens which failed to register on his equipment, and theorized that either the equipment was incapable of registering the higher level of velocities, or the projectiles had short circuited the boards during their brief passage through the substance. Different materials and alloys for the projectile fins had to be found that would withstand the rigors of the target velocities. The one obstacle that did prove insurmountable, however, was not technical, but financial.

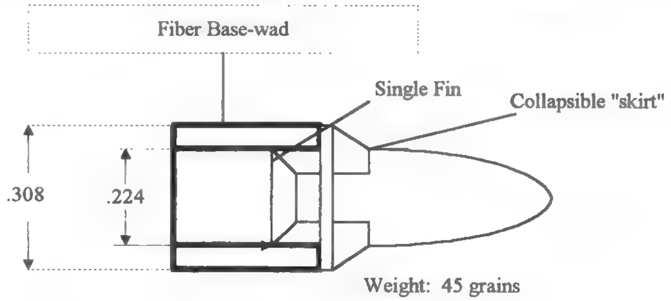
Appropriations for this project were cut short, and the whole project "shelved" at its prime, despite the tremendous increases in velocity that Howe was able to obtain over both Gerlich's original test rifles and ammunition, and the Army's efforts. In this time frame (1937) the M1 had progressed beyond John Garand's idea and resulting toolroom model into a demonstrable, firing rifle. The senior management at Springfield Armory was undergoing preparations to gear up and re-tool for the production of the M1 Garand. James Howe's hyper velocity project was shut down, and he was reassigned (briefly) to the troubleshoot some manufacturing problems with the M1 Garand. Discouraged, James Howe left the employ of Springfield Armory in May of 1937.

Unfortunately, this is where the "trail" stops cold, at least as far as the United State's efforts towards a high velocity arm. The British Government became interested in Howe's work and invited him to put on a demonstration in July of 1937, but technical problems with some test barrels while at Woolwich Arsenal, combined with an apparent lack of available funding by the British Army, closed the door on this chapter of hyper-velocity experiments.

Howe's later (1941 edition) Modern Gunsmith devotes an appendix to his high-velocity experiments. I find it peculiar that, in my reading, no more mention has been made anywhere regarding these "hyper" velocity experiments by Springfield Armory in the 1930's. Given the extensive amount of research performed by Col. Brophy for his book "The Springfield 1903 Rifles", I believe if more information was available from Springfield Armory, it would have surfaced.

The prototype tapered bore barrels, as you could imagine, must have been a real adventure to produce given the technology of the 1930's. Springfield Armory's test barrels were produced in house by the following process: The interior of the barrel was finished in 3 separate sections, with three sets of separate machining operations as one would perform to produce a single caliber barrel. Each section was drilled and reamed individually. What is not clear from these specimens is whether each section was (cut) rifled, and carefully indexed to meet the rifling of the next tapered section, or whether the barrel was rifled in its entirely after the tapered bore was drilled and reamed. Despite the elaborate machine work necessary to produce these barrels, Howe, a noted firearms writer, gunsmith, and toolmaker of the time, felt that once properly

Continued on next page



Howe's .30-.22 Tapered-bore Projectile

Figure 2

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[1] The author believes this comment to refer to the original 1937 printing of "The Complete Guide to Handloading".

Springfield Armory
Continued

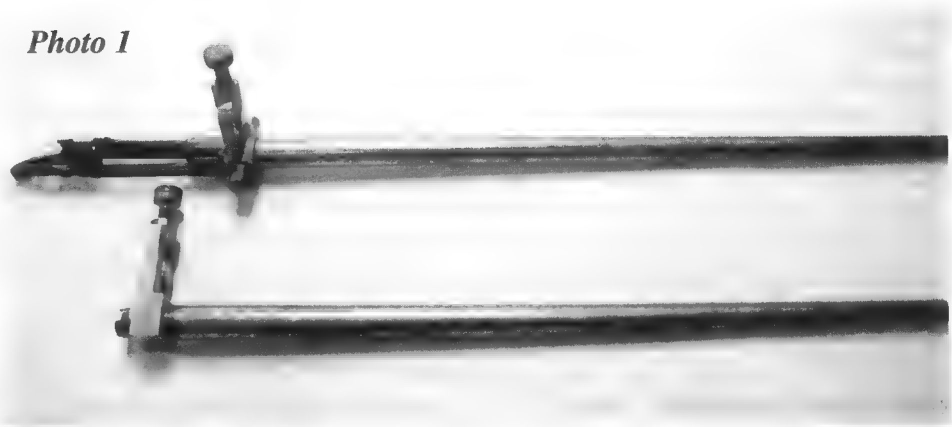

Photo 1

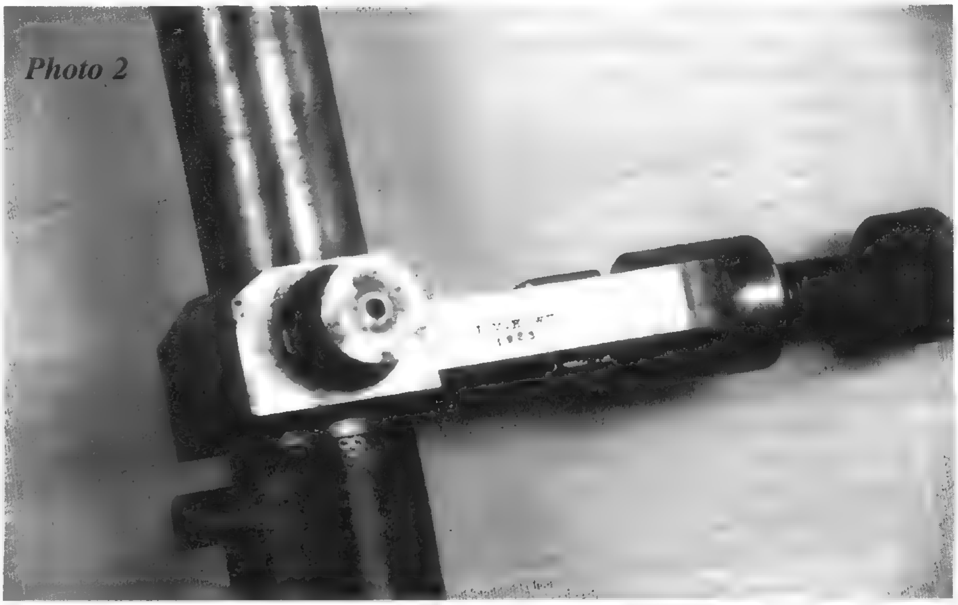

Photo 2

tooled up, the hyper-velocity ammunition and barrels could be produced at a cost only slightly higher than the existing .30 ammunition and barrels. In 1930 dollars, a M1903 .30 barrel cost anywhere from $3.00 to $25.00 or more, depending on length, and quality. Though not mentioned specifically in his published notes, "hammer forging" comes to the author's mind as perhaps the manufacturing process envisioned by Mr. Howe to mass-produce these barrels economically.

Two .22-.30 pressure test barrels are shown in **Photo #1**. Note the "crusher" type pressure testing devices mounted on both. The pressure barrel at the top has two cylinders on either side, perhaps for mounting into a machine rest to perform accuracy testing. Both barrels measure 29.5 inches long, with a diameter of 1.145" inches at the receiver, tapering to approximately .865" at the muzzle. **Photo #2** shows a closeup of the top test barrel and receiver, and the crusher device marked "J.V. Howe", dated 1923. The device is shop made, exhibiting excellent workmanship. The receivers used for these test barrels are "High Numbered" M1903 receivers, and appear ordinary in every respect, with the exception of a modification to the receiver ring where the "crusher" is attached. Judging by the date stamped on the device, it is safe to assume that these had been designed and built for Howe's previous testing, and the Springfield receivers (somewhat plentiful at Springfield Armory in 1937) adapted to fit the existing pressure devices. It is probably this modification that saved these historical artifacts from being turned into a nondescript deer rifle when this project was abandoned. The barrels themselves are otherwise entirely unmarked.

The "crusher" method of pressure testing, considered the most accurate means at the time of testing, used a device mounted as a collar around the chamber portion of the barrel. A hole was then drilled and reamed through the barrel into the chamber. A copper gas check is inserted to rest against the case wall in a loaded chamber. This serves as a seal upon firing. A steel "piston," lapped the fit the reamed hole, with both top and bottom surfaces lapped parallel, is now inserted. With the piston resting against the gas check, a copper or lead slug of known alloy (depending on cartridge type, pressure, and test organization) is inserted. The screw seen at the top of the device is carefully screwed down to rest on the top of the slug. The surface of the screw contacting the slug has also been lapped parallel to the piston. Upon firing, gas pressure expands around the interior of the case, and seeking the path of least resistance, blows a hole in the case where the chamber has been drilled while the bullet is being forced out of the barrel. The gas check seals the interior of the hole, and forces the steel piston against the slug, which is in turn stopped by the screw. The compression of the slug is measured, and the pressure calculation is determined based on the compression of the known area, length, composition and density of the material.

While this system was (and still is) widely used, ballistic engineers of the time recognized the following "standardization" problems, and/or limitations of this system:

1. Lack of standardization of crusher hole sizes according to cartridge type and expected pressure levels.
2. Inconsistent fit of steel piston, either in manufacture, or from wear/erosion
3. Variation in friction between piston and hole wall due to different lubricants and amounts used between shots.
4. Variation in location of hole in relationship to the head of the cartridge case.
5. Manufacturing variances in a) annealing of crusher cylinders, b) length and diameter of crusher cylinders, and c) use of crusher cylinders which have been pre-compressed during some stage of manufacture.
6. Variations in test conditions a) temperature, b) training of operators, and c) human element.

Photo #3 shows the set of chambering reamers for the ".22-.30'06". From top to bottom are the throating, roughing, finish,

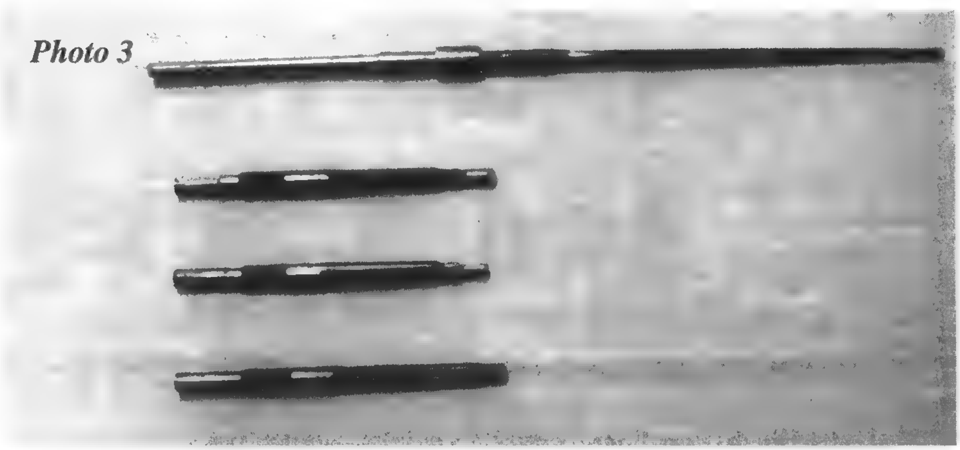
Photo 3

and as was the practice of the times, a burnishing reamer. It is difficult to distinguish in the photograph, but both the roughing and finishing reamers feature removable pilots. In Howe's "The Modern Gunsmith", he mentions the usefulness of removable pilots on chambering reamers - a feature that has only relatively recently been deemed advantageous by most commercial reamer manufacturers. These reamers are also shop made, and unmarked as to cartridge/chamber designation, date, etc. In "The Modern Gunsmith," Howe discusses the process of manufacturing chambering reamers in the shop, and while these reamers lack any identifiers, I am without a doubt that they are also the handiwork of Mr. Howe. The pilot diameters of .2988 indicate that the "chamber" end of the barrel (first of the three sections) was probably bored and rifled as a standard .30 caliber, and from there, it appears that the throating reamer bore the brunt of the work.

Examining the bore from the chamber, one views, beyond a doubt, the longest throat found on any small arm chamber. From my measurements, it appears that the 22-30-06 cartridge was intended to give the bullet a generous 4-5 inches to loose the .084 from its waistline. Howe mentioned in some of his notes that he worked on lengthening the expansion chamber (freebore) and throat to maximize velocities. A cast of the muzzle, shows the bore/groove diameter is approx. .224, and the rate of twist in the 1/10 range. Unfortunately, the throat of both barrels was pitted enough that repeated casting attempts proved fruitless. The pitting appears to be from storage and not firing. Needless to say, we have no means to even venture a guess as to the number of rounds fired through these barrels. Since no mention was made as to the barrel life during these experiments, we have no way of knowing if these barrels were the originals from the Army's initial testing from 1932-1936, or ones manufactured for Mr. Howe's 1937 testing, or even 2nd or 3rd generation replacement barrels.

Barrel life under sustained firing conditions could not have been very long given:

a) The "overbore" condition of the 22-06 cartridge;
b) the corrosive primers used by Frankford Arsenal (containing what was known as Priming Compound, or "Mixture" #70) prevalent at the time of these experiments,
c) the relatively high levels of nitroglycerine found in smokeless powder manufactured before World War II,
d) the relatively "soft" nature of the steel used in rifle barrels prior to World War II, and finally
e) the consistently high velocity levels that the experimenters were working with.

It appears, however, that these prototype rifles were not subjected to sustained firing, attributing to the generally good condition of the bore. It appears that these specimens were damaged more by neglect prior to disposal than from actual use.

The rifling near the muzzle appears to be in good shape, albeit rather shallow. Given the nature of the flanged Gerlich/Howe projectile, I would suspect the shallow depth of the rifling to be by design, rather than erosion. Measuring a few of the shards of my various chamber casting attempts, the lands of the rifling appear to be approximately .005-.006 deep, the lands appearing very rounded.

In researching this tapered-bore project, I found it interesting that ancillary notes from both Sharpe and Howe indicated that shooters of their time were experiencing many of the same problems encountered today. Sharpe mentions the "heartburn" with dealing with Springfield Armory to obtain .30 primers and bullets, the cost of packing charges, and handling fees. Many shooters today, grumble about the "handling" charges (that exceed the cost of the rifle) they must pay in obtaining a DCM M1 rifle. Don't feel alone, our predecessors 50-60 years ago were complaining about the same things! At least today we have multiple commercial sources of high quality loading components!

Looking at the global developments in military small arms at the time, I can only guess that the Army's decision to adopt the M1 Garand, and become the first nation to arm its troops with a semiautomatic service rifle vastly out shadowed the apparent need for a hyper-velocity service rifle cartridge in a bolt-action rifle. Given that production of the M1 rifle did not match the need for the rifles until almost 5 years of production, and World War Two was well under way, further complication of the introduction of a new service round could very well have spelled disaster for ourselves and the Allies. During this same time frame, across the Atlantic, the Italian Army was plagued with conversion problems as they struggled to convert their 6.5mm Carcano equipped forces to 7.35mm, and fight the associated logistical nightmare. Since more than one military historian gives the semiautomatic M1 rifle credit for enabling our nations' soldiers and Marines to win World War Two, there is some credence to this argument. Given the wartime developments of our enemies, and their attempts to field similar small arms, maybe the historians were right.

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A MATTER OF RECORD

BY JOE RYCHETNIK

I guess the first time I ever wrote anything down about my guns was in the Boy Scouts. I was in Troop 56 in a suburb of Chicago and our scoutmaster was a chemical engineer named William Kriz who demanded perfect record keeping regarding anything that went on in that troop. I think that his influence had a long standing effect on a lot of us who stayed with Scouting into WW II. We had some .22 target rifles in the troop and after finally getting past First Class, I was anxious to get my merit badges and Shooting was first on my list. The tough part of Scouting was getting the essential badges done and old Kriz would not let his boys play around. He was determined to have all of us First Class and headed for Eagle.

The requirements have changed a great deal since then but I remember the shooting advisor, an old WW I Army top kick whose son was in the same patrol as I was. He demanded we keep perfect records of our shooting, and of the rifle itself as he told us that rifles were like women. We didn't know exactly what he meant. We each had to keep a ring bound notebook with our targets and shooting data.

Since then I have kept a record of all my guns and over the 55 or so years, this has become quite a chore but a worthwhile endeavor. Those detailed records have provided a nostalgia trail into the mists of time, if nothing more. The ugly truth is that I have gotten lazy of late and had stuffed repair records and bills of sale into shooting buddy claims I am going to make it easy when the "feds" march in my home and seize my records and demand all my guns.

California is trying to go gun dry and when it goes, most of the nation will follow because we are one of the four or five "leader" states, according to the folks who study national trends. I tell Bud that when I see the "feds" coming down the road, I am running to the airport for a one way ticket to Alaska, where it will never happen. How I am going to get my arsenal there is another problem.

For many years I kept a bound journal with two pages dedicated to every "new" gun listed. There was every physical detail, the costs or trade value, and an envelope taped to a facing page that was filled with all the records. These important papers were the Bills of Sale, manufacturer's warranty and repair data, and most important of all, all the receipts for the repairs, customizing, accessories attachments such as scopes and slings, and other details.

That journal soon became distended to the point it took a truck inner tube rubber band to keep it "closed." It was a Dagwood sandwich of a journal and I soon has to start "Volume II." This was a very handy source of information when I was considering a trade and sad to say, a record of all the stupid trades I made over the years. As I have whined elsewhere, there should be a law against gun trading as almost every time I traded a gun, I missed it madly a few days or weeks later. There was only one gun I ever traded that I was happy to see go.

A newspaper columnist on the old Portland, Oregon "Journal" was anxious to acquire a single shot 12 gauge as a house gun. He did not want anything more complicated. He had covered enough crime beat stories to know that the 12 gauge was the weapon of choice when defending the home against unwanted boarders. He was an old Navy man that served on a heavy cruiser, and said big guns were the only thing that counted when trouble was on the horizon.

I had a Sears & Roebuck single shot 12 gauge that I kept as a loaner, as some duck hunters knew preferred to borrow a gun rather than buy one. It had a well-worn pad on the butt and was full choke, which meant it was "hard hitting," according to the writers of that day. I never shot anything to eat with it so it was ideal for a loaner, as I needed no real competition when the waterfowl season came round. To make a long story short, we came to terms. He traded me a .22 nine shot H&R six inch revolver that he claimed was used in the Olympics.

That revolver had something basically wrong with it, as I found that at ten feet from a milk bottle, it was missing by a foot. He got the shot gun which would have disintegrated the milk bottle at ten feet and I got a revolver that "was not worth fixing up," I was told when I took it to a downtown gunsmith. That nine shooter never could be traded or sold as everyone but me must have known it was a gun made only for starting foot races or celebrating the New Year. All noise, no hits. I finally traded it for a rusty Randall hunting knife that (fortunately) cleaned up real well. The new owner, who knew nothing about guns, took a hack saw to the barrel and reduced it to an inch or so of barrel and he reported it was great under his pillow or at the beach, rolling pop cans. I guess the long barrel was bent and needed chopping.

With 47 rifles and a large number of pistols to care for, the record book was about the only way I knew what I had and where I got it. When computers entered my life in 1983 I made a major effort to come up with a computerized gun list that I could add to and remove from at will. I even bought a software program that was advertised as ideal for "collections." After months of trying to make it work I called the HELP number of the software company and learned that the fellow who designed it was really not thinking of guns and knives (another fatal disease I have and can't shake off even in old age, when all collections start collecting the collector) but was into Hummel figurines! There must be a zillion such bits of what I call shooting gallery art out there and for those who want to keep track of theirs, this program would have been ideal as it was terrible for guns and knives.

When it comes to gun values I must say that cost and rarity are only two of the factors that I'd have in mind. Most of my trading pain comes from letting a gun go that has attached to it the smell of Hoppes and linseed oil that was applied after many wonderful days and weeks in the field doing what a fine gun should. I attach a lot of nostalgic value to shooting irons and get a lot of pleasure from just taking one of my rifles out of the case and "playing" with it. Memories return almost like magic. Handguns, with the exception of the long barreled Model 29 Smith, which is my favorite hunting pistol, mainly for wild boar, are tied to memories from my police days in Alaska and Modoc County, California.

But few people are interested in paying extra for a tired old gun just because it has connections for you to good times past. I gave my son in Anchorage a lot of guns but feel that it may not have been a good idea now as his wife is not only anti-gun and anti-hunting but she bases all this ill feeling against firearms on her religious beliefs. So my son has problems with that, over making guns and shooting a pleasurable part of his life. He and I had many happy times together on the annual moose and caribou hunts and always at the range, and I will leave his family affairs for his own resolution.

Getting back to values, I find that I get a shock and sometimes a thrill when I try to check up on a rifle or a pistol. I always pick up a copy of the latest GUN LIST tabloid at the local gun shop. With more than 35,000 indexed listings this biweekly offers the most concise education in gun values I can think of. I lay down $4 and pick up a week of reading and wondering about our world of guns. Years ago when I was desperate for a BRNO FOX .222 rifle magazine, I placed a want ad for one and was not surprised when I did not receive one response. I had searched for the rare magazines everywhere including Brno. I felt better when there appeared to be none around anywhere in the shooting world. But when it comes to checking what a Model 70 in .308 is selling for in the used gun market, you can get those answers by the dozen.

Collectors in very specialized fields such as English double rifles or Luger Parabellum pistols can meet all the best dealers and collectors in the pages of GUN LIST. Some folks are so into collecting or trading that they get GUN LIST by next day UPS deliver — about $475 a year. With UPS down these days it may make a nervous wreck out of these avid gunners. By the way if Fed Ex buys UPS I heard it will be called "FedUp."

My No. 4 has always loved to shoot trap but over the years, with bursitis and other complaints, she has been a bit shy of my 12 gauge guns. I have a Browning that has the gas action and a Magna Ported muzzle and a soft pad that makes it recoil like a 20 gauge or even less but she finds even that too much after a few shots. Now she has read that Bing Crosby had a similar complaint and was able to hunt and pop clay birds using a28 gauge. She is hinting along such lines.

It takes but a moment to look up a place where 28 gauge lingo is spoken in the pages of GUN LIST. I have plans to call Bill Hanus over in Newport, OR when LOTTO checks start to arrive. He specializes in the smaller shotgun bore and all it takes is piles of money. I told her that shot shells are a mite expensive — like a dollar a shot and not like the 12 gauge reloads we used to shoot by the box without thinking. She says she is worth it.

GUN LIST also offers information on gun shows, knives and knife shows, and features a nice selection of dealers in gun and hunting books. I think it is the best $4 a guy can spend if he wants to settle down for an afternoon of gun dreams.

Antique dealer Larry Platt told me he had a nice 1896 Krag rifle with original barrel and wood with some dings he'd let me have for a dollar less than $800 and I could use my credit card. I almost started to tell him about the Krag 1896 I had way back then and it cost less than $30 but I know he would say he heard it all before and those were the good old days!

The display ad that caught my eye was announcing that Chadick's in Terrell, Texas had some really nice Purdey's in stock. When I lived on the Monterey Peninsula a few years back I traded mainly with the Trigger Hill gun shop on the south end of Salinas. They had a great gun store; it was all well displayed. Whenever walked in, my favorite clerk, Tom, would yell out for all the others to hear, "Hi Joe, by the way your Purdey is in!" That would turn a lot of heads my way and I had to slink behind the reloading supplies display to avoid the stares. I looked far from what the Purdey owner should look like and didn't want anyone to think that I was just another lettuce farmer slumming in the shop.

I told Tom that one day I would call him on that greeting and then he would be on the spot. He gave me a wink and said that when I had Purdey money, he would have the Purdey.

I really prefer guns of a lot less value as long as they have charm and memories for me. The Model 24 Winchester may not be a Purdey, but my well-worn double barrel was good for many doubles on quail, once on chukker, and after I had the bore "regulated" by the fabulous Bill Nittler of Boulder Creek (no longer with us, I hear) it was a fine and fast duck gun over decoys. Every time I pick up that side by side to run an oily patch down the tubes I get a warm feeling.

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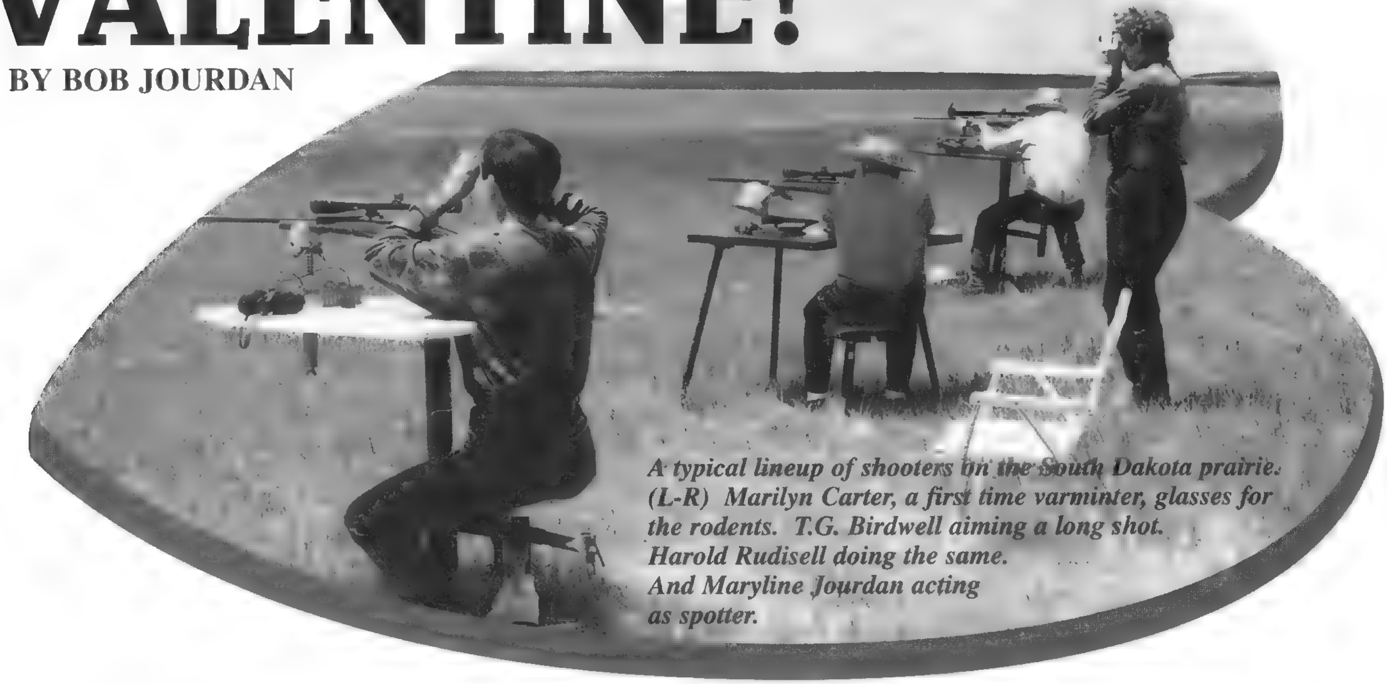
BY BOB JOURDAN



A typical lineup of shooters on the South Dakota prairie. (L-R) Marilyn Carter, a first time varminter, glasses for the rodents. T.G. Birdwell aiming a long shot. Harold Rudisell doing the same. And Maryline Jourdan acting as spotter.

The slick Savage M112 seemed to be shooting just a bit too high, even though I had sighted it in carefully before leaving for the hunt. At about 200 - 250 yards, I had seen the bullets striking over the heads of a couple of prairie dogs, not dogs at all, but actually prairie rodents. Then it crossed my mind that I was now using a little different type of ammunition, the new silver-boxed PMC, loaded with the 55 gr. Sierra Game King bullets. Back home I had used PMC, but in a common white box. Could that make much difference? Should I perhaps click down the elevation in the new 6x24 Weaver scope? Off came the cap, four clicks were turned to give a full 1/2" change at 100 yards, and it was back to searching for rodents.

Within a couple of minutes I spotted just the ears and black eyes of one of the little varmints sticking out of a mound only some 125 yards away. If my ammo and scope changes were guessed correctly, I should be about 1 1/2" high at that range, and a hold into the dirt just below the rascal would jerk him right out of his burrow. With a careful hold, just a bit of squeeze on the Canjar trigger, set below two-ounces of pull, and the .22-250 barked into life...and the prairie rodent was truly flung high out of the burrow in the warm, South Dakota air. The first registered kill for the new Savage...and verification that the new PMC ammo was most likely loaded to higher velocity.

This was taking place during the 1997 Prairie Dog Conference (PDC) held on the Rosebud Reservation of the Sioux Indian Tribe in South Dakota. The central town for that area is Mission, and the reservation's Natural Resources Department is in the village of Rosebud, some 15 or so miles to the southwest. The reservation has about 63,500 acres of first class prairie rodent towns, mostly scattered across Mellette and Todd Counties, on the Nebraska state line. The reserva-

Shooting systems varied. Here Bill Mazzarella is shooting from his low table and box with blanket front rest. In the background, Bob McKnight is spotting from his position set up to shoot over the truck hood from a Hart front rest.

Jim Spalding takes careful aim with a tall tripod set-up that allows shooting from standing. It was not as stable as from a bench, but was effective.

The best shooting set-up proved to be the rotating bench from BJ Enterprises. Here we see Harold Rudisell shooting his very accurate Remington M700 in .223 caliber. His front rest is a Hart, and the scope is the outstanding B&L 6x24.

Doctor Bob McKnight had one of the most accurate varmint rifles seen during the PDC. It is a full-blown benchrest type rifle in .22 PPC caliber. The scope is a Leupold 6.5x20, and the rest is a Hart with rubber feet to save the truck hood. He was the most consistent shooter beyond 300 yards that we actually observed, and he learned it at home on the Wyoming range.

tion is made up of three types of properties, Tribal lands, Allotted lands and Private lands. Tribal and Allotted lands require a Tribal hunting license and may be hunted on, if not posted. Private lands require owner permission, plus a state of South Dakota hunting license and the Tribal license. Since the PDC required more facilities than were available in the small reservation towns and villages, the official PDC headquarters was across the state line in Valentine, Nebraska. This, of course, placed all the participants just nine miles south of the big Rosebud Casino, where games of chance could actively be pursued by the many shooters.

The PDC is an invitation only shoot, originated by, and still under the direction of, Chuck Cornett, publisher of *The Prairie Dog Digest*, P.O. Box 9711, Fresno, CA 93793. He annually brings together about ten gun writers and 65 or so shooters for a very low key get-together, banquet or just plain bash, depending on how you might like to look at it. All the important manufacturers of shooting equipment send products to Chuck to give away in a drawing held after the banquet,

Continued on next page

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Valentine
Continued

and most of the important shooting magazines are represented and provide give-aways in the same drawing. An example of one of the great free gifts came from the various ammunition manufacturers in the form of perhaps 40,000 rounds of loaded cartridges for the use of all those in attendance. This ammo was in .17 Remington, .22 Hornet, .222, .223, .220 Swift, .22-250 and others. Norma even provided .22-250 moly-coated ammo for anyone to try out.

To get back to the shooting, my wife, Maryline, and I had been over in Wyoming for a few days prior to the PDC, and actually arrived in Valentine a couple of days early. We picked up our Tribal permits and met up with several other folks who arrived early, and we all headed out to try our hand at rodent shooting. We had three excellent rifles with us, one being the new Savage, another was the very fine Carbon One rifle in .22-250, and the third was a strange one for us, a .17 Mach IV on a Remington 40X action. The Savage carried a test scope from Weaver, the new 6x24. The Carbon One had a bright Leupold 6.5x20x50 mounted, and the little .17 carried a Leupold 24X. We brought the .17 along for testing in the real world, since we had no experience with one, other than on the 100 yard target range. The ammunition consisted of 25 gr. Hornady bullets ahead of a proper charge of Hodgdon's H322 powder. We used factory ammo in both .22-250s. Other equipment we consider absolutely necessary included our binoculars, our BJ Enterprises revolving shooting table, the Hart front rest and bags, and of course, all the cleaning equipment.

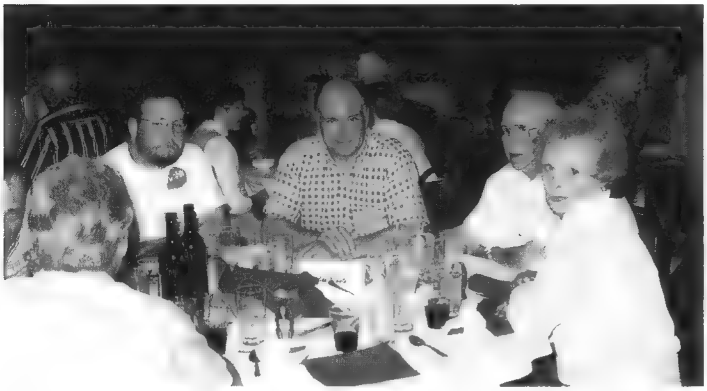
Since we teamed up with a couple of first time shooters, Jim Spalding and Marilyn Carter, along with T.G. Birdwell and Harold Rudisell, both experienced PDC shooters, we went straight to the Rosebud Natural Resources Department to obtain maps and new information. From there we drove out a few miles until we saw plenty of prairie rodents on both sides of the highway, turned in, asked permission at the first house, and set up to shoot. Jim and I both had 4x4 supercab pickups with CB radios, while Harold was getting by in a standard supercab pickup without radio. We stayed in fairly easy country to avoid the mud created by local storms of the last week, and to keep down the possibility of having to rescue Harold from any mud hole. Yes...we did pull his leg constantly about having to forego the best looking shooting places due to his weak pickup! All in fun....

The first few shots were not far out, and Harold's .223 showed up very well. Jim started with his .225 and soon found it to be one of the best varminters he had ever shot. He had obtained the rifle in a trade, but had no field experience with the caliber. Marilyn, who had been carrying a secret...being a slight Animal Rights advocate...started out with a good .22-250. This was to be her very first rodent hunt, or really, first of almost any kind of hunt. Jim had taught her the finer points of shooting an accurate, long range rifle at the range, so now it was simply a case of finding out how she might handle shooting those over-stocked rodents. She was somewhat surprised to find the Indians all wanting the rodents killed out, or at least thinned down to numbers that would not be so destructive to their grasslands and crops. This was not exactly the story she had been getting from her other Animal Rights associates.... When the moment came for her first shot at a live rodent, we all held our breaths. Would she come through...would she suddenly back down, put away the rifle...or perhaps deliberately pull the shot off target to avoid hitting the rodent...start crying...berate all of us...? Her aim seemed to take forever. We waited. Suddenly the report of that .22-250 cracked across the prairie. We saw the rodent fly into the air, centered by the little 55 gr. bullet. Marilyn jumped from the revolving table, let out a scream of success that could be heard all the way back to Rosebud, grabbed Jim and did a dance across that part of the prairie...happy as a kitten chasing a june bug! Need I add that today, long after the hunt, she is a prairie rodent shooting addict, telling all of us about certain animals having rights...the right to be shot? A true convert.

After we all got into the swing of things with our known rifles, I broke out the Remington 40X, .17 Mach IV rifle to try out. It shot fairly well on the target range under limited conditions. It looked like a true .500" rifle, with some targets

Three writers talking over the shooting agenda are (L-R) Jerry Horgesheimer of **Gunweb Magazine** *on the internet; Bob Milek, Jr., a well-known freelance writer; and Bob Jourdan,* **Precision Shooting** *staff writer. Each of the ten writers were teamed up with various shooters for the two days of prairie rodent shooting.*

The big steak cook-out in the Sweetheart Gardens on Thursday evening preceding the shoot found J. B. Hodgdon licking his chops and downing that steak! His major powder company donated a lot of powder to the shooters.



The enthusiastic crowd gathered for the final banquet in the Peppermill on Saturday night. Here we see (L-R) Lee Hoots, associate editor of **Rifle Shooter**, *Ron Coburn, chairman/CEO of Savage Arms, and Warren and Linda Nesting, prairie rodent shooters, exchanging ideas on writing, gun building and shooting.*

A real gang of California shooters happily waiting for the big equipment drawing...and perhaps showing signs of elbow bending...(L-R) Joe Gruna, Ed LaPorta, Jack Gruna and James Boyce.

shrinking to the .300" size. Naturally, there were also a few one-hole targets when the wind blew the shots together.... The unknown concerning this caliber seemed to be how it might work in the real world of the West, where ranges are unknown and the wind blows in many different directions. That 25 gr. bullet just did not seem to be enough weight to handle much wind, in spite of the many stories I had read about the .17 being a real long range varmint cartridge.

To start out, I selected the closest rodent still out of his burrow. He might have been 130 -140 yards out. I held the crosshair low on his fat middle and touched off that 25 gr. bullet at something like 3600 fps. It centered the rodent, but to my surprise, it didn't dismember him. I was too used to seeing the reactions to the .22-250 with 55 gr. bullets. Since most of the rodents within 200 yards had gone down in their burrows to stay, the next one was sitting out there at that range. The little .17 was sighted in for something farther out, but should be very well on at 200. I held centered, but hit a few inches to the left. The elevation looked good. I corrected the same as I had been doing with the .22-250 for the second shot. It wasn't enough by a whisker. The wind had come up a little, but certainly was not a problem with the .22s. I then made what looked to be the proper correction for the next shot, but it hit to the right. Either the wind switched, or let up completely. Before that rodent caught on to being shot at, I had missed him four times...enough of that. Then I waited for one closer in to try to rebuild my confidence. At about 150 yards, I hit the next one, but it did not explode. Back to the longer ranges where more shooting could be done, I spied one at about 250 yards and started shooting. At that range, no hold-over was necessary, but the wind was proving to be a problem. On one rodent that was facing to the right, I held on the shoulder and the wind blew the little bullet the length of his body, resulting in a poor hit in the rear leg. He ran to the next mound and started biting at the wound. It took two more shots before the wind cooperated and blew the bullet right into his middle. Then, after a number of misses, I turned the rifle over to Maryline. She immediately took a close rodent, and moved out to the plus 200 area. She, too, had troubles. By the time we had shot 30 rounds or so, and could only count about six hits, it was time to clean the barrel...and think it over.

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This break in the action gave us the chance to take out the Carbon One rifle, furnished by Dick Lyman of Christensen Arms, 192 East 100 North, Fayette, Utah 84630. It is a very expensive rifle, but is built on a standard Remington M700 action. The barrel is a Shilen match grade that has been turned down to only a half-inch diameter almost immediately out from the chamber. Then this thin barrel is wrapped with graphite/epoxy and brought back to normal diameter. Thus, the steel of the Shilen barrel could be looked at as being a liner inside the graphite/epoxy sleeve. This results in a very stiff and lightweight barrel. The graphite/epoxy also acts as a high temperature stiffener to decrease hot barrel movement. All this adds up to a very light rifle, about 6 1/2 pounds for the one I shot. During my sight-in period before leaving for the PDC, the rifle averaged about .600" groups with factory PMC ammunition. This is excellent accuracy. A year earlier I had shot one only briefly, and it, too, averaged close to the 1/2" mark. This limited amount of shooting showed us the light rifle would jump considerably when shot in the .22-250 caliber.

While the .17 barrel was soaking in Sweet's to get the copper out, I set up the Carbon One on the bench and located the rodents out past the 250 yard mark. The first shot was taken slightly downwind and resulted in a clean hit. After a dozen or so shots that knocked off a good half-dozen rodents, I turned the rifle over to Maryline. I had found that it could be held rather firmly and the recoil jump would be very well dampened. Maryline held accordingly, and started shooting. I went back to cleaning. When the first lull

Continued on next page

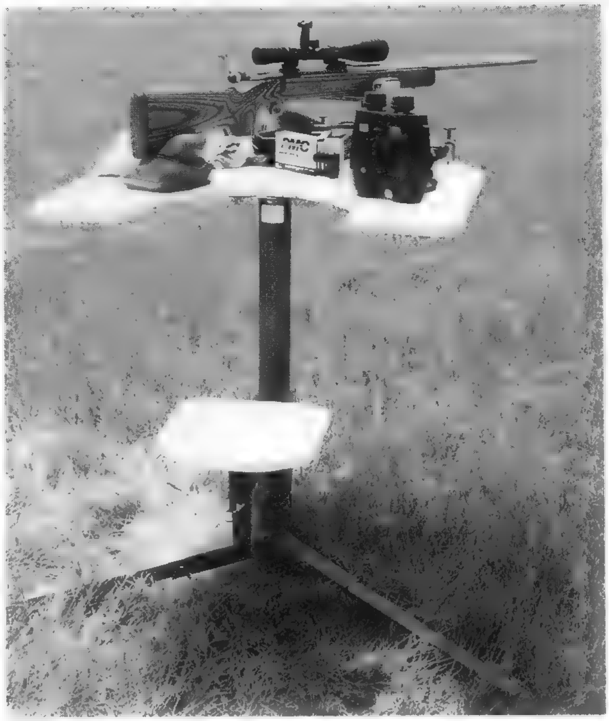
Valentine

Continued

in the shooting came, I asked her how she liked the rifle. Her bright smile told it all! She was averaging better than 50% hits out to around 300 yards, and doing it with the light rifle. I couldn't continue letting her do all that good shooting, so I hurried the cleaning of the .17, asked her if she wanted to shoot it any more...no...and put it away as a lost cause. We had compared it to Harold's .223 and decided it was not the equal, and of course it was not in the cards to be as good as the great .22-250s. Before the PDC was over, we had compared the little .17 to several different calibers and finally decided it was close to being equal to the standard .222. On a perfectly calm day, however, it would easily be comparable to the .223. I am not sure I have ever shot varmints on a calm day....

We gave the two .22-250s a real workout the rest of the day. Once in a while we would hear a cry from T.G. Birdwell when he would accidently (our opinion!) hit a rodent out around 300 yards. And as it turned out, Harold was competing with T.G. by shooting at the same rodents. Too often, when T.G. missed, Harold would reach out and make the kill with his .223. On the far end of our shooting line, Jim was trying his rifle from the rotating bench as well as from a tall tripod rest. That rest was for standing up and shooting, and it worked very well. I think if we would have counted all the hits of the day, Jim and his .225 would have been in first place, and the .17 Mach IV would have carried all of us who shot it into last place. The .22-250s and the .223 would have been in a dead heat...at least out to around 300 yards. Beyond that, the .22-250 was the hands down favorite.

On the next trip out we had the company of Roy and Wanda Damron, experienced PDC folks that we had the pleasure of visiting last fall during the Colorado deer season. Roy had his .22 Cheeta and .220 Swift, and his truck was also a 4x4, without CB radio. By use of the radios, Jim and I could discuss ideas on where to go for shooting. When Harold and Roy would set up to shoot in some area, Jim and I might go off a couple of miles and find a better location, but couldn't tell them by radio. Anyone hunting in a team should have a communication system, generally a CB. It is the way to stay in contact, and very useful when lost...or stuck in the mud....



Many shooters might consider this the ultimate prairie rodent shooting set-up: A revolving shooting table; Hart rest and leather sand bags; Leica Geovid rangefinder binoculars; Savage M112 (left-hand) FVSS, converted to the Savage laminated stock, and in .22-250 caliber; an after-market trigger from Canjar with the pull set at two ounces; the new Weaver 6x24 scope with 1/8 MOA adjustments; and with a Scoplevel standing on the scope to show the bubble level at all times. Some would claim it would be difficult to miss with this set-up, but I can attest to that not being correct!

Thursday evening was the big steak cook-out in the Sweetheart Gardens of the Peppermill Restaurant. Since it was only across the street from the Comfort Inn, the PDC headquarters, it was easy to come and go. This was the first get-together of all the PDC crowd, where old and new friends meet. The writers mingle and visit with their many readers, and the readers get to deal directly with their favorite writers. Manufacturing moguls are there, and we were lucky to have Ron Coburn, Chairman/CEO of Savage Arms present. He fielded many good questions concerning why the Savage M112 was so accurate, right out of the box! And before the entire PDC ended, he had several shooters approach him to let him know they wanted one of those hot-shooting Savages. The fact that he brought along one of his own rifles (amazing!) in .220 Swift, and showed just how accurate it was, may have been planned....

Friday morning was the beginning of the official PDC hunt. A dozen Sioux guides met us and we were set up in groups. I was with Doctor Bob McKnight of Wyoming, and Bill Mazzarella from California. We loaded all our gear into Bob's 4x4 supercab and headed down the road, close behind the guide, Paul Paulhamus. Paul turned out to be an excellent guide, but when he suggested we shoot in the shadows of a housing addition and hospital, we may have raised our eyebrows.... It turned out to be a great prairie rodent location! Paul had inside information that the area had not been shot-over too hard.

Bill was first out with his minimum shooting gear, a small folding table and chair, topped off with a box and folded blanket for a front rest. His Remington M788 carried a Tasco 3x9 scope, and the caliber was .222 Remington. During the day, he knocked off many a rodent within 100 yards, and didn't miss many at 150 or so. But beyond the 200 yard mark his hits became few and far between. And of course, after only a very brief bit of shooting all rodents within that range were deep in their burrows. Then Bill was obligated to try those 250 -350 yard shots, to little avail.

Bob set up across the hood of his truck. He had recently had an operation on his knee and could not sit very well, but standing was not a problem. He had rigged rubber feet on his Hart front rest to protect the finish on the hood, and proceeded to show us how a little .22 PPC, in full-blown benchrest configuration, could reach out and touch those far away prairie rodents. His scope was a Leupold 6.5x20, a very fine choice for that caliber when used in the varmint field. If memory serves me, he had loaded that little cartridge to send off a 52 gr. bullet at a bit over 3450 fps, making it about a 100 fps faster than the .223, the second most popular caliber of the PDC.

My set-up had become somewhat standard, being the Savage M112, 6x24 Weaver and factory .22-250 ammo with 55 gr. bullets. But a secrete weapon had been added the night before when Terry Moore of Leica Sports Optics, slipped me a set of those awesome Leica Geovid rangefinder binoculars. They work on the laser system, sending a beam out to reflect back to the binocular, be received, have the time counted, and then converting that into distance and showing the numbers in the field of view. It is more or less instantaneous, and the binocular I was using indicated range in meters, easily converted to yards. I tested them on many varmints, and when the background and circumstances were right, I could range the rodents out to about 800 yards. On something like a big, fat steer, the Geovids bounced back the correct range easily to 1000 yards. Thus, with the Geovids in hand, there was no room for excuses on misses due to range!

On several occasions, I'd be scoping a big rodent out around 350 yards or so, when suddenly it would explode from a .22 PPC hit. After this happened a couple of times I had to give up my shooting and move over toward Bob to get a better view of his work. Within a few minutes he had shown me how to score on four consecutive rodents, all in the 325 -350 range, with one shot each. He doped the wind, figured the bullet drift and drop, and made the shots!

In the meantime, Bill was having his troubles with that little .222, trying to get a rodent now and then beyond 250 yards, but having no luck at all. Since I was enjoying the rest, and the use of the Geovid rangefinders, I turned my revolving bench and .22-250 Savage over to him and became his spotter. He had never seen the new 6x24 Weaver scope, and was carried away with the higher magnification, compared to that of his scope. Also, it took just a little dry-firing to get him used to the fine Canjar set trigger. The first shot or two resulted in firing before he was aimed, due to his habit of placing his finger on the trigger of his M788. The Canjar pull was about two ounces; his M788 was about five pounds! Another advantage he found was in using the steady, revolving table. All he had to do to turn into shooting position on some rodent was to push slightly with his feet and revolve to the alignment. Finally we found a good prairie rodent target, only some 200 yards out. The Geovids corrected us...only 178 yards. Bill put the crosshairs on the middle of the rodent, held a second or two, and touched off the shot. My binoculars showed a major explosion of rodent, bits and pieces going in every direction. Bill was ecstatic! This called for a picture, to show his first kill with a real, down-to-earth varmint rifle. And it set him to thinking about getting home and ordering out a rifle just like it. Yes...he could see retiring the old M788....

As the day wore on, Bill and I alternated shooting both the M112 Savage and the Carbon One rifle, both with about equal results. Bill stretched his hits out from that first 178 yards to one that ranged by the Geovids to 314 yards, a good hit in anyone's book.

Friday night on the parking lot of the Comfort Inn looked like a rifle convention. Dozens of shooters were set up with tables for cleaning rifles and reloading ammunition...and carry on with tall tales...mixed with elbow bending, various combustible mixtures with spring water or tonic, etc. Had this been going on in almost any location east of the Mississippi, the long arm of the law would have been working overtime.... But out West, this is not at all unusual. No one is looked at twice for carrying a rifle down the street. Many pickups have a rack of rifles in the rear window, right out in plain view. And crime statistics show that crime is much lower than in the heavily gun-regulated East....

Saturday was a repeat of the preceding day of shooting. We went to different locations, generally, but enjoyed the same high quality shooting. By mid-afternoon, we all packed up and headed back to Valentine for the final night and the special banquet in the Peppermill. The best steaks and salads, the best companionship, the best after dinner drinks, the best stories of the best shots of the week, and finally the best give-aways one could imagine. Chuck Cornett was master of ceremonies, introducing the many manufacturers and thanking them for their participation and donations...knowing fullwell that this event is better advertising than most paid spots on TV, radio, newspapers, etc. The shooters had nothing but praise for the products they saw and had the opportunity to use during the week. Chuck was presented with the "Dogfather" award, a fine, fat prairie rodent mounted, under glass, in a handcrafted oak frame. This was followed with the drawings and give-aways, with all the ladies helping Chuck distribute the goodies. The prize of the night was the Savage M112 rifle, but that doesn't mean that the fine Nikon scopes, Burris scopes, Pentax scopes, Bushnell binoculars, Harris bipods, AMT Custom rifles, Hodgdon, Barnes, Sierra, Winchester and Federal powders, primers and bullets, and dozens and dozens of other shooting products were not welcomed by each and every person there. No one went home without a number of fine gifts.

Sunday morning was pack-out day for most of the shooters, but there were some who planned to stay over for a few more days of banging away at all those prairie rodents. Some were moving on to other locations or even other states for more shooting...but we writers all had to get back to the business of reporting on all the fun those fellows had!

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PERSONAL OPTICS

or the Fuzzy Peep

BY BILL DITTMAN

Over the years, I have read many articles on vision and its effects on shooting. One aspect of this subject matter which affects many of us older shooters, is cataracts. What does one do if he is diagnosed with having cataracts? This malady, usually associated with age does not mean that you have to quit shooting. In fact, the correction of cataracts may make you a better shooter than you were before.

My eyesight problems began when I was about twelve years old. I was sent from school with a note which said that I had failed an eyesight exam. I was promptly sent off to the optometrist for glasses. What a difference this makes in your shooting. I never knew that you were supposed to be able to see the bullseye at a hundred yards. I had assumed that everyone just aimed at the center of that fuzzy beige square out there. My shooting abilities experienced a major improvement.

Everything went fine for many years. My eyesight and my shooting ability stayed pretty much constant. I went from glasses to contacts, to soft contacts, to bifocals.

Several years ago during a routine exam, my optometrist said "you have a little opacity in both eyes." My response was of course, "What do you mean a little opacity?" "Oh it's nothing to worry about, it's just the beginning of cataracts. If it gets worse, it may require some attention, but for now, as long as it doesn't affect your acuity, its nothing to worry about." "Oh good, as long as I'm not going blind."

Everything rocked along fine for about five years. One day at the range I was sighting in my Hopkins & Allen muzzleloader which I had equipped with a peep sight. Sighting downrange, I noticed a ball of fuzz in my peep sight. I blew through the sight to clear it. The ball of fuzz was still there. I tried sighting with my left eye. The ball of fuzz wasn't there. After the initial panic subsided, I settled down to a reasonable reaction, I'm going blind. My next trip to the optometrist confirmed my estimate of the situation, "Yes, they are getting worse. They still aren't affecting your acuity so there is no need to be alarmed. If they ever get bad enough to affect your acuity to the point that it affects your work, you may want to have them attended to."

Everything went along reasonably well for a couple more years. I could still shoot reasonably well, especially with scope sighted rifles. My spotting scope developed that same annoying ball of fuzz which my peep sight had. Of course I could use the spotting scope with my left eye. Still no need for panic.

A couple more years and things got a little worse. My acuity was getting worse. I was having trouble with fine detailed work, not a good situation for someone trying to be a machinist. Road signs had to be a little closer before I could read them.

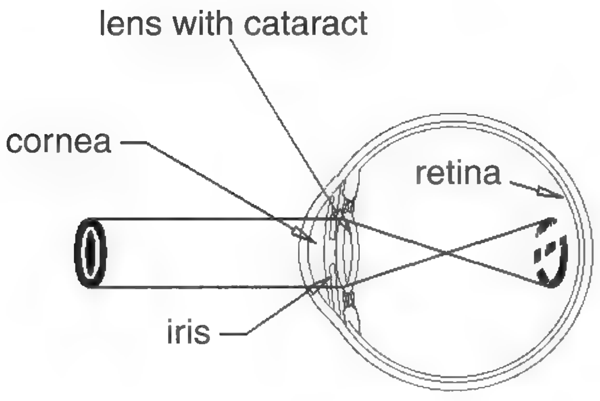
Back to the optometrist. "I think its about time I do something about my cataracts." "Yes, they do seem to be getting worse. We will send you down the surgeon. Don't worry, there's nothing to it. My father had his done last year and he went out for lunch with me the same day he had it done." "Good. Send me to the same doctor you sent your father to." He told me that the surgeon would only do one eye at a time. "Once you have the first one done though, you won't be able to wait to get the other one done." Yeah, I bet. I'm dreading this like an appointment with an all night dentist and he says that I won't be able to wait.

The first visit to the surgeon was easy. A complete eye exam. They also measure your eye with an ultrasonic device so they can put in a lens which will give you the best eyesight. Then the explanation of the upcoming procedure. The problem is an opacity of the lens. This is the lens behind the iris (the colored part of the eye), not the cornea which lies in front of the iris. They would remove the lens and replace it with a plastic lens. This would take about an hour and would be done next Wednesday. "Wait, can't I think about this for a while?" "No. Be here next Wednesday." A few more instructions and I was sent home.

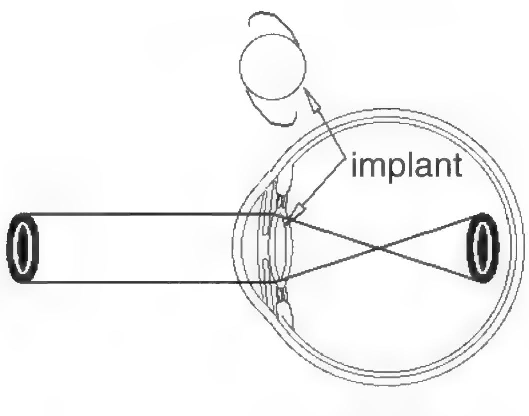
Wednesday came and it was back to the doctor. A shot in the arm and a couple, four to be precise, around the eye and they wheeled me into the operating room. The procedure was done while I was wide awake looking through the eye that they were fixing. There was absolutely no pain. It was really a fascinating procedure. Twenty minutes later they said, "That's all, you can go home now." I immediately found out why my optometrist's father went out for lunch. I was starving to death. I had been forbidden to eat after supper the night before surgery.

After a month of healing time, it was back to the optometrist for new glasses. The exam showed that they had hit the lens selection perfectly. I was 20/20 at distance. I needed glasses for astigmatism and bifocals for close up work. The optometrist explained that the new plastic lens doesn't change shape at all so there is no focusing ability. He said that at my age, I had almost none anyway.

The procedure is technically known as a cataract extraction or intraocular lens replacement. The original lens is broken up with a ultrasonic device and removed with suction. A plastic lens which has small loops or springs on either side to hold it in place is inserted. The entire procedure is done through a very small incision which requires no stitches.



EYE WITH CATARACT



CORRECTED EYE WITH LENS IMPLANT

The optometrist was right, I couldn't wait to have the right eye done. A few months later it was back to the surgeon. With both eyes fixed, it was amazing how much better I could see. I could see better than I could ever remember seeing before. Not only was everything clearer, but colors were much brighter than I remembered. Trees and grass are not only green, they're bright green. Not only is there an immediate and noticeable difference in acuity, but that annoying ball of fuzz is gone from my peep sight. My immediate reaction to this amazing success was to do what any reasonable person would do, buy a new rifle.

Pain? Almost none. After the first surgery, I took two over-the-counter pain relievers. After the second surgery I didn't take anything. I went back to the surgeon the morning after surgery for a two minute look to make sure everything was all right and I went back to work that afternoon.

It has been two years since the second surgery. Everything has been fine. I can even hunt deer without glasses if the weather gets really bad and my glasses fog up. I haven't been able to do that since I started hunting forty seven years ago. I have even taken up benchrest shooting (reason for the new rifle). I wish I had a good excuse now for my miserable performance at the bench.

As I mentioned before, there is a problem of not being able to focus at different distances. The lens which permits the normal eye to focus at different distances by changing shape has been replaced with a plastic lens which doesn't change shape at all. Consequently you can focus only at one distance without help of lenses (bifocals or trifocals). This is not normally a problem. I function quite well with bifocals. This inability to focus at different distances may be a problem to some shooters however. Bob Reiber, pistol and rifle shooter, has had cataract surgery. He says that he can see a four inch spotter at six hundred yards but the front sight on his rifle and pistol is a little blurred. Your optometrist can fit you with glasses to permit you to focus at any distance you want. You merely have to decide what distance you want. If you want the front sight clearly focused and the target a little blurred, your optometrist can prescribe glasses to do that. It helps if your optometrist is a shooter too.

The point of this whole story is that if your doctor tells you that you have cataracts don't be alarmed. This is one of those rare problems which they don't merely treat but actually fix. Not only can they fix the problem but you may be better off than you were before the problem existed. Isn't modern science wonderful?

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PRECISION SHOOTING INTO THE NEXT GENERATION

BY
GENE BROWN

A range of rugged outcroppings called the Cabinet Mountains are planted solidly on the western edge of Montana.

Near the Idaho line they flow down across peaks and valleys filled with rushing streams, small, isolated angling lakes and abundant lakes and abundant game. Here roam elk, deer, bear of both the Black and Grizzly persuasion, an occasional Caribou and other wildlife of the four and two-legged variety.

These rugged natural beauties roll to a stop at brush and tree covered knolls which make for dandy bullet stops. One of these rises is a hundred yards wide, about half that distance high and is in my backyard, the woods of North Idaho between Sandpoint and the border of British Columbia.

Here under tall Evergreen and Birch trees are conducted unorthodox, informal courses centered around the shooting of rifles, pistols and an occasional shotgun.

This is not activity evolved from sanctioned formal training or detailed manuals but the result of much trial, experimentation and fun times. The aim is to encourage interest in the safe handling of firearms by young people. Time has proven that it is a method that works well.

Planting seeds to nurture a lifelong interest in the sane use of hardware for hunting and target shooting goes like this.

A parent, either mother or father, understands the reality of guns. They believe, and rightly so, that it is better to have a youngster who understands and respects shooting irons than to give them the mushroom treatment. That is to keep them in the dark and feed them...well, we needn't get graphic about it.

The youngster, anywhere from age seven to eighteen, is dropped at my place for the day.

They are taken, sometimes with their folks along, to a backyard shooting bench where I have gun cleaning gear, targets, assorted gun accessories and a firearm. Parents can stay also but most opt not to.

My training piece for years was a Winchester Model 67 single-shot which somehow got traded off and I now use a Remington single-shot .22 rifle. I favor these basic smallbores because they require pulling back on a bolt device before they can be discharged, an added safety feature for novice shooters.

First, we clean the breech and rifle bore. All students are firmly instructed to always inspect any gun for loaded condition and then to check for barrel obstructions.

Then before we commence firing, a detailed discourse on safe gun handling is slowly gone over. At day's end I usually give them a print out of The Ten Commandments of Gun Safety.

Okay, buddy, you're doing good. Now, here are the different ways you can shoot a rifle or pistol. This statement is followed by a demonstration of the prone, sitting, kneeling and standing positions.

What are we supposed to remember about all guns? That's right. ALL GUNS ARE LOADED AT ALL TIMES!

By now the budding Nimrod is fairly eager to get in some shooting.

One .22 long rifle cartridge is loaded and locked. First shot is from standing position. A target is fairly close by, anywhere from five to ten yards. I use bullseyed paper on a haybale, empty pop cans which can then be recycled or water filled plastic jugs. Never are glass bottles or jars even considered.

Before releasing the rifle I have also had the kid put on ear protectors and safety glasses. The latter as a result of bygone days of my Red Ryder, 500 shot carbine with a compass in the stock and dire warnings of "you'll shoot your eye out, kid!"

The green youth's first shot on the road to competent marksmanship is with heavy squinting and a hard lean into the stock before a first round is squeezed off.

That first .22 caliber pop is followed by a "Not bad. We're all still alive. You did pretty good."

Sheepish grin. Then they get to load up on their own. This for some kids can be a fidgety, tongue out the side of the mouth business. I have spent an inordinate amount of time keeping barrels pointed down range with a gentle hand nudge.

It can take anywhere from two to 25 rounds before they get the proper feel of it.

After their latest shot is fired I feign shock over something in the woods. After a "Well, I guess that wasn't a bunch of dancing girls or wild Grizzlies," I mention how seeing as the gun has just been fired it must be unloaded. Right? The little head nods yes. While their attention was distracted I had quietly slipped another round into the chamber. Aiming down range I let fly. Bam! It makes an impression. What did I tell you? That's right. They are all loaded.

Comes now the unorthodox department.

Contrary to widespread media reporting, most hunters and target shooters know how to read, write and count to eleven without removing their shoes.

In fact most successful hunters that I know have large, interesting libraries as do their breathren in the bench rest crowd.

When my wife and I owned a bookstore we had many a frustrated parent or teacher who sought our advice on how to pry a current day adolescent away from

TV, couch potato land, and into the world of reading.

To develop youthful reading interests there was one sure fire book.

It is by Daniel P. Mannix and is called *STEP RIGHT UP!* It's the true story of a young man who after hitting the road, gains employment as a fireeater and swallower of swords in an itinerant traveling roadshow carnival of the 1930's. Teenage boys especially like this one. Amongst other good books Mannix also wrote *A SPORTING CHANCE* on unusual methods of hunting, and with Peter Ryhiner authored *THE WILDEST GAME* on capturing live, wild animals in Africa.

I have them read Mannix's carnival work and then follow up with a recommendation for, *ISHI: THE LAST OF HIS TRIBE* which is on the discovery of America's last true wild Indian, early in this century. Ishi gained renown not only for his heritage but as a compatriot of famed archers Pope and Young. Ishi's story is also available on video for family viewing.

The foregoing books are not uncommon in used bookstores.

Most of the younger set who read these works are ready for more. Not only are their shooting abilities better but improvement occurs in the mind department.

I feel they are now ready to dig into one on guns and hunting.

Elmer Keith, if you don't know, was a somewhat opinionated fellow whose name was champion class in many arenas. He rode the 1920's Montana wild bronco circuit, played a major role in developing the .357, .41 and .44 Magnum calibers, hunted from Alaska to Africa and led an interesting and adventurous life with a fine woman named Lorraine on a ranch at the North Fork of the Salmon River in Idaho. Aside from guiding the likes of Zane Grey and gaining fame as a hunter and shooter he wrote nine books between 1936-1979.

Included in these volumes is one entitled *HELL, I WAS THERE!*, which is an expanded version of his earlier biography published in the 1970's by Winchester Press.

Some parents may not care for the title but they are usually pleased with the results when Junior gets locked into reading Elmer.

The America of Elmer Keith was a much freer place which most young readers quickly pick up on. His life, almost impossible to duplicate today, seems to fascinate them.

Some magazines can also be of interest and help to budding shooters.

Not to puff up some editors, but *Precision Shooting* and a couple of others do not show up at the Gun Show cheap table. They are collected for articles and valuable ballistics and firearms data. Guys glom onto these publications and don't easily cut loose with them.

What you will easily find all over America at Gun Shows and in used bookstores for about two-bits apiece are 1950's and 1960's copies of the *American Rifleman*. For a buck you can provide the young bunch with a batch of informative and oftentimes inspiring reading on shooting and hunting.

In between reading sessions I graduate the pupil up to a Ruger 10/22 rifle. First,

Continued on next page

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Precision Shooting Into The Next Generation

Continued

one with iron sights and later to a scoped model. There are lots of other suitable semi-auto .22's you could use but this one works best for me.

Some kids are content to gain proficiency with just the .22's. If interest warrants and it is okay with their folks we do handgun studies with a Harrington and Richards Model 929, a solid basic little revolver. Our beginning shotgun is an Iver Johnson single shot .410. The use of anything more sophisticated or of a larger caliber is not recommended.

I've seen youngsters become gun shy because some Bozo thought it cute to put a .357 revolver or 12 gauge smoothbore in their hands early on.

If interest is shown I take them around to the homes of reloading buddies. We show them basics and tell why special loads, cases, particular bullets are used. After load experimentation we go up to a five-hundred-yard pit a short distance from my place where the effects of these different loads are demonstrated. Discretion dictates whether or not I do all the shooting with a larger caliber rifle or let them have a whirl at it.

After the initial training sessions I share hunting experiences with them. They hear about elk, deer, antelope and bear pursuits around Idaho and Montana. There is no painting of one hundred percent success pictures.

Related are absolute horror stores of late autumn, rain soaked and snow slushed canyons, many missed shots, fogged scopes and other joys not often shared by writers of outdoor lore. There are also tales of campfires, Venison backstraps, the best hunt of my life in Wyoming near the South Dakota line, pan fried Trout and rolled flour Grouse dinners with a touch of Tabasco sauce.

Sparking an interest in hunting even with city kids is easy. In spite of broadly published anti-hunting propaganda a goodly number of our current up and coming generation is more than ready to head out into the wilds for pursuit of finned, furred or feathered game.

Pushing the bench rest button is a different matter.

There a different ways to guide young lads into the world of competitive, long distance shooting.

I handle it like this.

At the range or on the road we discuss sports. Monday night football, the World Series, surfing, bicycle road racing and boxing are along the glamour line. Right? Watched by millions.

How about thousand meter Running Board or Deer meets. Ever been to a thousand yard shoot? Have any idea of what it takes to get good at that? Most of them know zilch about these subjects.

In 1969 and 1970 I worked as a volunteer during the 40th World Shooting Championship at Black Canyon Range which is a grand layout located north of Phoenix, Arizona.

At the time my shooting had been confined to deer and bird hunting, pistol activity at the old South Coast Range in Irvine, California which is now defunct and quite a bit of reloading and varmint shooting on a large dairy farm in Riverside County.

At Phoenix I coordinated shooting and other activities under Colonel Joe Gregory. During my duties I also made many rewarding acquaintances with foreign team members.

One of these strangers to our shores was a soft spoken man from Sweden named Martin Nordfors who my fellow volunteers said was a man to watch.

It is true that professional athletes go through agony and deep water to excel. We know this because of an inundation by television specials that reveal famed jocks in training.

After observing Nordfors who was the 1969 Running Deer champion in Sweden my interest in and respect for long distance shooters swelled immensely. Knocking down a mule deer at 300 yards hardly compares with the ability to punch concentrated holes into paper a thousand yards out there.

With competition at the 40th getting down to the nitty gritty, speculation and assumption were rampant on the firing lines. It was claimed widely that the Russians or East Germans would walk with the thousand meter competition. We all, of course, pulled for the U.S.A.

On the thousand meter range Nordfors was a study in concentration from the time he cinched up his shooting jacket to the minute he zeroed in on that far, far away running boar target. A man with experience in these matters told me how the mind of the master shooter from Sweden was computing the wind, temperature, weather, choice of loads and everything else that went into successful precision shooting.

Norfors had set a new world record for distance shooting in 1969 in Sweden. Before the day was through in Arizona he was the World Champion Running Boar shot, with all the attendant glory at ensuing awards banquets.

To my knowledge his world class accomplishment did not result in widespread fame and fortune. Never saw him on the telly as a highly compensated pitchman for tennis shoes, toothpaste or headache remedies.

In telling kids about this I stress the highly individualistic nature of the shooting game. Sure, the glory of being a top dog in spectator sports is nice. But, there is something very special about having what it takes to squeeze that trigger. Just right. And, hitting what you aim at no matter how small it looks out there on the target line. So, kid, it's up to you. You want to be a herd person or one who can run their own rewarding show without mob appreciation? Do you have what it takes for that?

In light of the fun we have had shooting, some understand and others could care less.

A few I know have been saved from drivel and drugs by just starting them out on the simple rudiments of a lowly .22 rifle. From this they grow into a world that offers a feeling of accomplishment that readers of shooting journals well understand.

Precision shooting has rewards well worth passing on. If you ever get the chance to share your shooting knowledge with the up and comers, do so.

Chances are more than good that fine times and pleasant memories are in store for both teacher and pupil.

It would be a shame for this fine sport to languish for lack of interest and knowledge and participation by the X-generation and their offspring.

(Editor: Our writer here is the author of the book *"Elmer Keith, The Other Side of a Western Legend".)*

PILLARS OF WISDOM

BY PAUL HUNT

As I explore the subject of extreme ***rifle*** accuracy, more and more I have begun to understand it as a tranquil oasis of flowering equipment craft, surrounded by a vast desert of confusing human factors in precision ***shooting***. How pleasant it is for a concrete footed bench, supporting solid rifle rest hardware, which in turn supports a perfectly conforming stock, rigidly married to a solid action, trued to a perfectly machined barrel, precisely directed through magnificent optics, to flawlessly launch a marvelously concentric bullet, from a carefully detailed cartridge, into the same hole as the previous nine shots. But sometimes the beauty of this drill is unfulfilling. High Power competitors have ventured out some, but still feel compelled to limit the risk with straight jackets, glue, and elaborate sling rituals. Well, perhaps it's the Bedouin in me, but I feel drawn to leave the comfortable garden of rifle certainty and venture into the wilderness of ballistic discipline. I am a Silhouette shooter.

Siluetas Metalicas, as the Mexican inventors call it, is a game of human factors. I am fairly certain that at least 99% of the rifles that have been shot at the Silhouette matches I have attended were capable of a perfect score if only they weren't required to be fired by flimsily clad folk standing in the wind without support. Playing the game at any level is almost entirely a personal contest to master one's own body and mind. Still, even with this obvious focus within the game itself, there is precious little discussion, much less systematically documented research, concerned with indentifying and mastering the game's human factors.

I dove into the matter at the 1997 NRA National Rifle Silhouette Championship. Early in the match my own dismal scores prompted me to consider what the real reason was for me to be there. Chronic problems which had plagued my last year of shooting were still evident. I decided that I would no longer suffer in silence, But I would screw up the courage to seek advice from the world's Master shooters who had gathered in Raton for the matches. Being a lowly AA clasified shooter myself, I reasoned that the Master shooters may take pity on me and offer some useful hints. Sure enough, everyone I approached was quite open, and I also found that many of the other aspiring shooters were eager to hear what was said. So I am now compelled to turn what began as a casual personal inquiry into a more involved research, and survey Master class shooters on a variety of human factors in their game.

Of course, even limiting ourselves to the silhouette game, there are too many human factors issues for one brief article. I selected three to begin with knowing that all the multitude of issues were so interconnected that discussions about these three were bound to uncover a lot of miscellaneous related information:

1. How precise is the Natural Point of Aim (I'll abreviate as NPA)? It's hard to imagine anything natural about aiming a rifle off-hand (except maybe its necessity in combat and the hunt), but whatever precision an off-hand Silhouette position will naturally deliver cannot make use of clothes or glue, and must contend not only with the wind effects on the body, but also the fact that each shot is made at a different target.

2. Where on the animal is the trigger point? Irregularly shaped animal silhouettes lined up against rough ground do not provide the crisp aiming point that black on white paper punching games enjoy, but there are many interesting possibilities for selecting specific places on each animal that might serve as a more refined point of aim.

3. Is the trigger point the center of a hard hold or the goal of a controlled approach? The sight picture wobble that remains after an off-hand position is built must still be nudged, conjoled, relaxed, or wished into final alignment with enough sureness to fire on call. Choices must be made as to how to accomplish this last bit of control, because the training required to perfect any one option is probably the toughest and most time consuming art of the game.

I have summarized the responses to these three issues in a table at the end of this article. But, the principles behind the individual choices are more universal and you can see this clearly in the context of the Championship match which brought us together.

The First Day

"Rebuke a wise man and he will thank you." - Old Jewish proverb

I started the competition with a "game plan" that I had tested in practice sessions for only a couple of weeks, and in competition at a local match only one week earlier. I would adjust NPA on each shot, and set my sights for a 6 o'clock hold on the animal's belly or leg/body joint. During my last month of practice I had developed these ideas to combat a chronic problem of my sights sticking below the target (I call this my gravity problem). In addition, I had been practicing a side to side approach to the target for over a year, but now I found that my trigger pull was anticipating the trigger point too far in advance - often before the sights even crossed into the silhouette. I reasoned that a more careful setup of NPA for each shot would help to reduce my tendency to fade down on the target, and the finer point of aim would keep me from anticipating the trigger point too early. But when the real shooting began on Sunday I found I was hard pressed to even shoot a score within my classification. Maybe

Continued on next page

Pillars of Wisdom

Continued

my plan was bad. Maybe I hadn't practiced enough to make my new plan work well. Maybe it was my nervousness at my first national match, or the strangeness of shooting at the Whittington Center range for the first time, or the bad dinner I had in town the night before.

I first approached **Tim Kurreck** (Tim is classified Master in the Shilhouette game, and for the balance of this article, unless specifically noted otherwise, everyone referenced is a Master classified shooter). I have watched him shoot at our California State Silhouette Championships where he is one of a small group who chase each other for top honors. The first thing I noticed when these rivals shoot together, often spotting for each other, was how much time they spent analyzing each shot. Typically, Tim will load, carefully mount his gun, and fire within the first 10 seconds of the average 30 seconds allotted for each animal. Then he exchanges information with the spotter, casually musing about fine details of the shot for what seems like most of the safely remaining time before beginning to mount his gun again in a relaxed manner. Since he never appears nervous about the clock himself, it's not unusual for his spotters to feel obliged to be nervous for him.

Tim's disdain for the clock is just one outward sign of his search for detached objectivity. "I approach shooting as an engineering problem. I analyze my performance and try to isolate problem areas. Then I'll try to develop drills which will allow me to focus my practice on these problem areas. Finally, the drills must be carefully controlled and monitored for effect." As an example, Tim uses the hard hold approach to prepare the sight picture or trigger point, and in order to develop the necessary steadiness (in Tim's case, less than 2 minutes of angle) he practices holding his sights within a dot just slightly smaller than his natural wobble. As his wobble improves, he reduces the size of the dot to refine the drill. However, in monitoring the effectiveness of the drill he found that trying to hold on a dot that was radically smaller than his natural wobble just made things worse. Other common problem areas that benefit from this approach to training include trigger control (for Tim this means breaking within a 1/2 MOA trigger point) and follow through (another 1/2 MOA allowance) where Tim uses dry fire exercises, and carefully monitors his live fire in ideal conditions for 1 MOA groups centered on the trigger point.

However, Tim believes that if shooters rely on conscious attention alone they will generally peak out in mid-AAA scores. "You must somehow prepare the subconscious to get beyond that, into consistant Master level scores." To this end, a lot of his choices are made to provide "a relaxed feel - natural position." He doesn't expect his NPA to be finer than a bank of targets. He makes no foot adjustments during a 5 shot string, but uses other adjustments such as back twist and slight hand adjustments, to center the sights. He's careful about what he eats in order to smooth out blood sugar levels. And then with all this preparation he adds one more step: "You have to visualize everything before you do it. I visualize each shot before I mount the gun - the exact placement where I want my subconscious to activate the trigger." When I told Tim that I was thinking of writing about my survey of the game's human factors he said: "So much is mental. That's what's good about shooting. But it's also the hardest part. People won't listen. They'd rather focus on equipment, or look for some quick fix, but there is no quick fix."

When I asked Tim about my gravity problem, without pausing to think, he said: "Oh, that's psychological. It's fear of failure." It seemed to me that such a confident diagnosis would surely come with a confident cure, but Tim's advice was subtle: "Stay focused on your process and performance and not the outcome. The outcome is a natural benefit of performing correctly."

The Second Day

"What's for breakfast?" - Oklahoma farm boy after 3 hours of morning chores.

I was beginning to get some natural objectivity in my own shooting. I noticed that in fact I had not been following through on my game plan completely. I was not checking my NPA on each target. Sometimes I'd catch myself and go back to the plan, but then the wind would kick up, and with my body swaying and jerking, I would find it almost impossible to know where my NPA really was. Also, I began to wonder if a fine point of aim was even possible in the wind. Maybe I'd be better off with something bigger to wobble my sights around.

Of course, **Lones Wigger** is a well known multiple Olympic medal winner and world class champion in many shooting disciplines. But I was still surprised to see his skill in shooting the same windy conditions that were worrying me. I watched as he calmly dropped ten rams in a row in winds I guessed to be about 25 mph with his small bore hunter rifle (for those of you not familiar with the game, the small bore silhouette hunter rifle must be a common factory .22lr rimfire sporting rifle weighing 8.5 lb.s or less including scope, with the original single stage factory trigger set to no less than 2lb.s of pull. The rams are about 2.5 inches at the chest and are set 100 meters from the firing line).

As I spoke with Lones about his game he modestly said that his ten rams were probably due to a healthy dose of good luck. But "luck" tends to accumulate where someone has done a lot of good work, and Lones Wigger definitely believes in work. "A shooter must develop a work ethic," he says. "The most common problem for beginning shooters is that they will let the shot go before it's ready and hope that it hits." In his own words he "builds" his position for each shot, he "works" the sights, "works" the trigger, he "works" to follow through each shot, and he "works" the whole match.

Lones' off-hand position assumes an NPA that covers a bank of targets. "NPA is not as critical in off-hand as it is in sling supported positions," he reasons. He relies on no particular approach to the target, but takes up slack on the trigger as the sights come into the animal, tightening as the hold settles. As he described this, something about his hand gestures and the words he chose gave me the impression that he was conciously working each milisecond from the time he mounted the gun to the moment the bullet hit the target. In contrast to his refined work on each shot, my shots usually feel more like crude struggles where I might even have huge gaps in concentration about the time the trigger goes off.

As we talked about his point of aim he

said that he looked for some dent or nick on the body of the animal to help refine his aim, but sometimes it was hard to find such features with enough contrast. He was considering switching to a trigger point like the body/leg joints on the animals, but he cautioned: "I would have to work on this in a lot of practice before trying it in a match. I'd be afraid I might lapse into old habits with my sights on the wrong setting."

I asked Lones about my gravity problem, and he looked puzzled. He'd never heard of that kind of problem before. Maybe his "work ethic" approach inoculates against psychological problems like fear of failure.

The Third Day

"It keeps going, and going, and going, ..."
- Eveready Battery Co., Inc.

By now the match had lost some of its initial sparkle. Keep in mind that local matches are always an easy half day affair, and even State matches are no more than two days. By making the Nationals three half day matches for each of the four different rifle styles, a pace is introduced that some don't recognize until the third day. There has been enough time for the fickle New Mexican mountain weather to demonstrate its majestic extremes; everyone has come to accept the limitations of the benches, shade, and rain shelter; the local restraunts have all been reviewed; and for many of us, two days of scores are now beyond repair. But for some this is the time to really shine.

I wanted to talk to **Cathy Winstead**, a young, quiet, top contender with a very consistent game. She was familiar to all of us from her frequent trips to the winners' circle each evening for various honors in the daily awards ceremonies. But, for a good part of the day whenever I had time to look for her she was sitting at the center of a circle of friends all buzzing around her as if to absorb some of her calm assurance.

Cathy told me, "Of course I've had my ups and downs." But when I asked her to recall details of any specific down period she honestly couldn't remember. She just keeps trying to do her best. As for my survey issues, she sets her NPA for a bank of targets; she has developed a hard hold using a dot drill very much like the one Tim Kurreck described; and she releases the trigger on or just anticipating the sights coming to the center of the animal, "never as it's leaving."

One technique she described particularly interested me: While she is waiting to shoot (and presumably during the lulls in her friends' attentions) she will mentally fire an imaginary match. I'm familiar with this technique from my piano recital days. Some see it as a meditation where the imaging acts as a kind of force that draws one into perfection. I always saw it as a clever and efficient way to extend my practice time right up to and including the minutes before taking my turn at the piano bench. Cathy refers to it as mental preparation, and it probably plays an important role in her consistent performance.

The Fourth Day

"Pride may come before a fall, but it's what lifted me up in the first place." - Hellen Keller

As the ancient story goes, God poured out his wisdom into creation through six steady days of labor and rested on the seventh. However, for creating a silhouette national championship, to include both small bore and high power in the space of one week, it seemed common human prudence to take our rest sooner. In the first three days we competed for small bore hunter rifle and small bore standard rifle categories at the 100 meter range. In the last three days folk would compete for high power hunter rifle and high power standard rifle categories at the 500 meter range. Now we took one day in the middle for everyone to relax or do their laundry, whichever seemed more pressing. Fortunately or unfortunately, personal matters allowed me to attend only the first half of the full week of matches. However, I thought I'd use a combination of Cathy Winstead's technique of imagination together with some second hand reports to continue constructing the whole event. As it turned out, other Master shooters I had surveyed in the first half of the week, almost like prophets, had already given me a view of the themes of the remaining days.

I arranged to talk with **Marco Barriga** while he was resting between matches. His excellent shooting in the first three days had won him the title of U.S. National Champion for small bore standard rifle. For me it seems natural that a shooter from Mexico would win. We did, after all, import the game from there. Besides, I am a citizen of San Diego County, the lower left corner of the continental United States, and there we are regularly humbled by the shooters who cross the nearby border to compete in our local matches.

Marco is a charismatic sporting enthusiast. Like Cathy Winstead, he spent much of his time during the match in the company of friends, but unlike Cathy, he is anything but a calm center. In fact, Marco and his friends are usually engaged in lively and merry banter. During a bad rainy stretch, they were having so much fun mocking each other's misery that one of them missed the start of his scheduled relay! It would be several days before the U.S. shooters would reawaken to the fiesta heart of silhouette shooting. For now, the merry Mexicans, with the whole group sharing in collecting a healthy portion of match honors, represented the inevitable force of confidence.

Marco attributes good peformance to whatever confidence he has in himself. Conversely, poor performance comes from confidence lost, and what ever problem is behind the lack of confidence, it must be found out and cured to get back on track. When preparing his position, Marco will set his NPA on the bank of targets. Usually he sets up on the center animal first and makes slight twists in the torso to bring the sights into each animal on the string. He tries for a hard hold, or as some of my Spanish speaking friends say: duerme en la punta (sleeps on the dot). He imagines a dot in the center of the animal and he focuses his mind on this point. As he concentrates on this trigger point his sights automatically center themselves on the same point and at that magic moment the trigger goes off. He describes the whole sequence as a conditioned reflex set off by his focus on "the dot".

Many of the practice techniques that Marco uses rely on quick and constant feedback to continuously reinforce his confidence. For instance, he will load dummy rounds (what he calls 'jokers') and randomly insert these into his center fire practice ammo to get frequent feedback on his recoil flinch; or he will

Continued on next page

Pillars of Wisdom

Continued

practice alternating each live round with three dry fire rounds to help spotlight his follow through. He also plays a variation of the game with his friends where the animal silhouettes are printed on paper, and within each animal is a circle around the center of mass. The shooters then score points with the center circle worth 10, any other hit on the animal worth 5, and 0 for a miss.

"You know, some of the big shooting sports have traditions of coaching, and major sponsorships, but not Silhouette," Marco pointed out. "We must work on ourselves." The gleam in his eye made it clear that he considered this to be not just a challenge, but one of the best features of the game.

The Fifth Day

"It is better to give than to receive." - A Truly High Master

Amateur shooters from around the world have come to Raton for these games. Each participant deposits an official score book or other documentation certifying their past scores in competition as proof to their classification. In truth, the real proof of a shooter's standing lies in the fact that we know each other from regular state and local club matches. Even if someone wanted to sand bag, the teasing from others would overwhelm any joy of victory. So, I have begun to see my score book more as a souvenir. Each line in the book lists the club that sponsored the match and provided the range facilities; and the initials beside each of my match scores remind me of the match directors who donated their time and encouragement. I appreciate the spirit of generosity - whether it is in great things or small, it contributes some measure of nobility to us all.

As a top competitor, very active in the NRA's national silhouette committee, Tony Tello contributes a healthy share of ennobling spirit for the rest of us. "When I'm shooting, if things aren't going real well, I begin to worry: what am I doing here? Why didn't I just stay home? It's important to me to feel like I'm contributing something. Being active in the silhouette committee, now I worry if this year's rain will discourage next year's turnout, and will light turnout discourage NRA support?"

Tony's NPA covers a bank of targets so that he only needs horizontal adjustments to settle on each target. He works on a hard hold, with his trigger releasing as the sights approach the point of aim. Also, he usually holds on a spot in the body of the animal, but if he's having trouble he may change his sights to aim where his hold seems better. He practices all this often by shooting at different points of aim like legs, heads, or 12 O'clock on the back.

Being on the silhouette committee means that Tony is constantly having to do a variety of tasks during the match to keep things running smoothly for the rest of us. It's not easy to deal with these interruptions and still compete well. "Even in the small bore game you should wear double ear protection because it helps against distraction," Tony councils, and as further help in developing concentration he recommends Lanny Bassham's coaching books & tapes.

"After 20 years of shooting silhouette I am still trying for a perfect score," Tony told me. "You're out there with no support. It's easy to fall apart, and most of us are self taught. Maybe that's why this is the hardest shooting discipline." Tony shouldn't worry. After all, his contribution is already making things better.

The Sixth Day

"If you're too clever, you could miss the point entirely." - Old Tibetan saying

Now, to have made it this far into the story, I assume that everyone agrees with my claim that human factors in silhouette shooting reduce equipment differences to virtual insignificance. But just because we all agree doesn't mean that we have to quit arguing. One faction at the NRA nationals feels strongly that the importance of human factors means that we should have rules to limit a dangerous high end technology race. They fear that new shooters might be discouraged from joining because of a mistaken belief that they need some high end space gun. And, of course, those opposed say that since equipment matters so little, they should be allowed to tinker to their hearts' satisfaction.

Charlie McClure thought that this debate could use a dramatic illustration. He competed with a custom rifle few would dare shoot, much less envy. He took a Mossberg barreled action and mounted it in a hand whittled two by four that looked like a reject from some contractor's scrap pile and had bounced from building site to building site for a least 10 years. A split in the forend was held together by some long rusty nails that had to be bent down on one side, and except for the single strip of electricians tape that served as a cheek piece holding down the splinters along the top left edge of the stock's butt, I would have guessed the design to be ambidextrous.

Charlie struggles with balance. He's noticed that he has a tendency to go to extremes. "Silhouette shooting is just a game," he says, "but it can still break marriages. I can get real excited about the challenges and easily forget other priorities."

As Charlie and I talked about my three survey issues he was quick with details about his techniques, but always cautioned me about the effort in training they required. Charlie works on holding on a spot on or around the animal and when his hold is good his wobble is no more than 1 minute of angle. He described massaging the trigger when his sights are "on the dot." If the trigger doesn't go off when it should then he just brings the sights back for another try.

For Charlie the search for balance extends to the teamwork required between a shooter and a spotter. The shooter should be able to trust the spotter's sight adjustment coaching, but the spotter needs accurately called shots from the shooter for this to work. Charlie recommends that they practice this by shooting at paper targets together. The paper targets will help to reinforce their mutual objectivity.

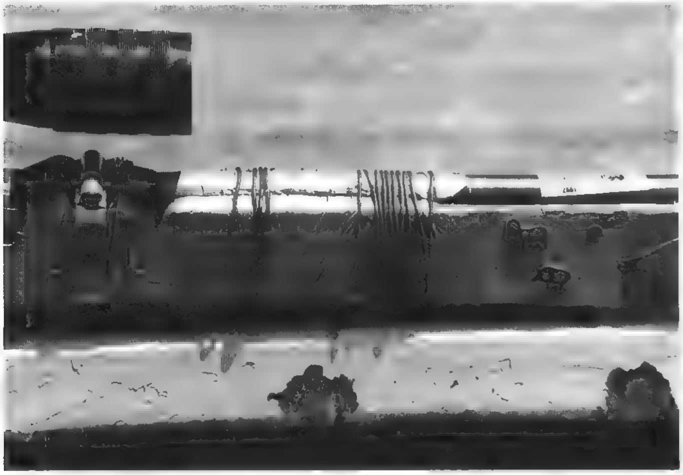
"There are," Charlie says, "a few shooters who are on another plane, but for most of us it takes a lot of practice and focus to shoot well. My advice would be to take your time and don't forget your priorities."

The Seventh Day

"First learn the instrument. Then learn the music. Then forget all that s—t and just play!" - Charlie Parker

The silhouette game evolved from impromptu matches among bragadocious

Charlie McClure and his 2x4 custom rifle.


Close up of the elaborate bedding on Charlie's rifle.

Jeff Boyer (left) with Jim Hebenstreit, Arizona Silhouette Committee Chairman.

hunters enjoying themselves at a public fiesta amid the aroma of good food and the laughter of children. It may not serve to take ourselves too seriously, even if this is a national championship match.

Extreme weather continued to challenge everyone during the high power matches, and on Saturday the wind decided to make it's own dramatic illustration and blow so hard that the pig targets wouldn't stay up. It was decided to shoot at the swingers. Who needs regulation targets anyway. Let's have some fun! After a week of intense competition, mother nature took it upon herself to remind us all that without a fiesta spirit to fall back on, worrying over fine tuning of equipment or technique could be just a vain exercise.

Jeff Boyer shot pigs that morning in a relay before Saturday's windy lesson was forced on everyone else, so I can't say for certain if he agrees with my interpretation of events, but his sense of humor is always finding playful ways to turn struggle into fun. For instance, he arranges shooting time around his son's sports practice: "I like to attend his games," Jeff says, "but when he practices I'll just drop him off, then go to the range to fire a few rounds, finishing in time to pick him up for the trip home and some refreshment together." He also told me that his local range only has chicken and pig targets, but that doesn't seem to bother him. When he competes as a guest at other clubs he just cheerfully concetrates his warm up practice on turkeys and rams.

Though he agrees with everyone else in describing his NPA as being no more precise than a bank of targets, Jeff is the only Master shooter I interviewed at the match who unequivocally claims to shoot controlled approach to each target. "I always come in from high and right, and I'm squeezing the trigger as the reticle is in the black and heading towards center," he explained. He emphasized that either the shot goes off automatically somewhere in the black as his sights approach center or else he lets up on the trigger and comes back around for another pass.

Jeff has some creative exceptions to his rules, as well. If he has 2 or more misses in a row then he will insert a practice dry fire before loading the next live round; and if the misses are grouped in the same area, then he will try to break the pattern by approaching the next shot from a different direction than his usual high and right.

Jeff's careful responses to my survey questions left no doubt that he takes his shooting seriously, but his light hearted personality seems to keep him fresh for a unique and rewarding approach to the game.

Summary

As promised, here is a table summarizing the various responses to my first 3 sight picture issues. It is, of course, only a sample of the top shooters at the match, and I regret that I did not have the time or boldness to talk to more. It's also obvious to me that many other shooters had valuable insights worth sharing, even though they had not yet received Master classification, but time and space has dictated an arbitrary limit on the list of folk here.

I expected a variety of responses. It would just back up the common wisdom that there are many different ways for shooters to develop their skill, as well as the fact that even Master shooters are constantly changing and experimenting. However, I was surprised

Continued on next page

Pillars of Wisdom *Continued*

Sight Picture Survey Results

Master Classified Shooters	NPA Precision	Hard Hold vs. Controlled Approach	Trigger Point
Barriga, Marco	Bank	Hard Hold	Center
Boyer, Jeff	Bank	Controlled Approach	Body
Kurreck, Tim	Bank	Hard Hold	Center
McClure, Charlie	Bank	Hard Hold	Various
Tello, Tony	Bank	Hard Hold	Various
Wigger, Lones	Bank	Hard Hold	Center
Winstead, Cathy	Bank	Hard Hold	Center

at how much they all agreed, namely no-one expected the NPA to do more than keep them on a bank of targets, and all but one uses some variation of a hard hold rather than a controlled approach.

In spite of what these excellent shooters say, it seems obvious to me that there would be value in building an off-hand position with an NPA refined to hold close to a single animal. Jeff Boyer told me I was looking for something that doesn't exist, but I have a theory about how it could exist, at least for the hard holders: It is possible that settling a hard hold is the same thing as refining the NPA for each shot down to 1 or 2 MOA, and once the NPA is that precise why not just pull the trigger. These shooters might be saying, in their own way, that taking a shot is position, the whole position, and nothing but position. I've tried some of the hard hold practice techniques since returning from the match, and I definitely get my best improvement in wobble by making minute shifts in finger, wrist, and back position rather than muscled leverage. So if my theory is true, it follows that we will all have to get more precise in our use of terms, like NPA, in order to effectively share expertise.

The subject of human factors in extreme shooting accuracy is certainly deeper than this brief article can explore, and for most of us our ignorance is so vast that I imagine decades of information exchange in journals like this one may just begin to define the terms. Perhaps I have added to the subject here by collecting a few pearls on sight picture, training, and a bit of miscelany, but volumes could follow expanding these and other areas such as mental prepartion, position, trigger control, and follow through. Though I look forward with anticipation to the accumulation of this research, I am reminded by the sages:

"One shot at a time." (Proverbs 10:19)

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EATING THE ELEPHANT

One Bite At A Time

BY JAKE GOTTFREDSON

It has been thirty five years since I lived for a while in Chicago and met the old Lithuanian. We were both security guards for a major department store, making little for our efforts. He became a bitter man when he reminisced about his native country and talked of his newly adopted one: America. The old man would illustrate the political inequities that brought him to uproot his family and move to the US by explaining that he could not carry a weapon for self protection in Lithuania. Now in America, he was faced with some of the same outrages that had forced him to leave the old country. Chicago, even then, was strict about weapons.

As a twenty year old fresh from a small community in the mountains of Utah, I was befuddled by his strong feelings. I had never considered such problems because I had never realized they existed. I grew up with guns; they were as much a part of the lives of my people as were shovels, horses, or farm equipment and vehicles. It was almost impossible for me to identify with or truly understand such deep seated feelings when my world seemed to harbor no apparent ills. It was 1960 then.

But now I am confronted with the same problems that had beset the old Lithuanian, causing him such distress that he forsook the old ways for the freedom of America. The same reasons for which our founding fathers labored for the long lasting precision of the constitution. I am beginning to understand the depth of the old man's bitterness, for now it is growing in me.

The tenants of the Crime Bill became effective September 13, 1994, amending the Gun Control Act of 1968, and with if another huge bite was ravaged from the average citizen's rights and freedoms. The old Lithuanian understood that without the second amendment there is no constitution; he understood that the basic right to own guns in an effective way was the right to protect himself, but also to have the government fear him instead of the other way around.

The law now states that, "it is generally unlawful for a person to possess semi-automatic assault weapons"; that, "it is generally unlawful for a person to transfer or possess a large capacity ammunition feeding device (more than ten rounds)". But there are exceptions: they can be possessed by governmental entities or law enforcement officers employed by governmental entities for official use or by law enforcement officers. However, semi-automatic assault weapons and large capacity ammunition feeding devices can be possessed by the average citizen if they were possessed prior to September 13, 1994. What does this mean? For one thing, it means that the police and the military can possess small arms weapons with more firepower than the rest of us can. It means that some lucky individuals who are not police or military can possess them but others can not. It means that either the government plans to discriminate against some law abiding citizens and not others, or that the government has plans in the future to remove all of the weapons from its citizenry whether possessed prior to September 13, 1995 or not.

The Federal Firearms Regulations Reference Guide dated October, 1995 makes reference in their statement of purpose that, "it is not the purpose of this title to place any undue or unnecessary Federal restrictions or burdens on law-abiding citizens with respect to the acquisition, possession, or use of firearms appropriate to the purpose of hunting, trapshooting, target shooting, personal protection, or any other lawful activity, and that this title is not intended to discourage or eliminate the private ownership or use of firearms by law-abiding citizens for lawful purposes ...". However, when the Federal Firearms Regulators determine the lawfulness of a firearm, they do so by testing it against their definition of sporting arms, not self protection arms or arms to protect the state. In fact, the guide does not make reference to "self protection" again, only to "sporting use". The intent of the Second Amendment was not to protect our right to use sporting arms to hunt or shoot targets, yet it is this that the government seems most intent on protecting. It is naive to believe that one can defend oneself against assault rifles and large capacity ammunition feeding devices with a five round, bolt action hunting rifle. But let me assure you, it is not completely naïveté; beyond the government's design, it is also apathy and the average citizen's position too far removed from the horrors of the past and the struggles outside our own borders.

The Texas Constitution did a good job of giving the right to it's citizens to carry weapons and protect themselves until the 1960's. These rights were bitten into by the Gun Control Act passed in 1968, more laws enacted in the 1970's, again in the 1980's, and bitten to the very marrow by the new Crime Bill effective in 1994. Then the concealed weapons law was passed in 1995. This law discriminates

Continued on next page

Eating the Elephant

Continued

against those who haven't the funds to pay for the instruction and the permit. It now discriminates against those who do not have a permit regardless of the reason. It subverts the laws prior to it and the Texas Constitution itself. We had laws in place necessary to protect ourselves before these laws and the concealment law was ever passed. But now the erosion begins.

Laws are being passed and restrictions instituted or talked about every day in Texas to keep concealed weapons permit carriers from making use of it's intent. Can one then fall back on what the Texas State Rifle Association and the NRA said they had lobbied so valiantly for and had retained: the original laws as well as the new concealment law? Can one fall back on the Texas State Constitution for the right to protect oneself? Certainly, if you are in your own home and don't have children, for if you do, the laws are so restrictive that you could never retrieve and use the weapon within any reasonable time frame. Can you use the right of "Travel" so often necessary if one travels across the state or through the city streets. Certainly, if you don't mind taking the time to pull over, stop, get out and move to the rear of the car, open the trunk and retrieve the weapon, or climb in the back of the Ford Explorer, fetch the locked container, fiddle with the lock and finally retrieve the weapon — at which time, by the way, you are once again in violation of the law. But certainly the concealed weapons permit allows one to do this in the great state of Texas. Certainly, if you don't mind circumventing the city because you might at any time find yourself within one thousand feet of school, or remembering that you had to stop at the liquor store to pick up the wife's Kahlua for the bridge party, or that you find yourself on any kind of public property, or that you must take the bus to get home, or that ....

The fact is that you cannot effectively carry a weapon to effectively defend yourself unless it is against whitetail deer on the exorbitantly priced deer leases here in the state, or in your home — if you own one. However, if you aren't fortunate enough to own a home, you haven't an effective legal right to protect yourself with a gun in any case, anywhere. When the law is read, the discrimination becomes perverse and laughably ridiculous.

It is unlawful for a private citizen to purchase or posses a Heckler and Koch .45 caliber semi-automatic pistol with a magazine capacity greater than ten rounds. A HK .45 pistol utilizing a ten round magazine is indeed sold on the open market. However, an identical pistol utilizing a twelve round magazine is sold to law enforcement personnel only and a similar one to the military. What is the meaning of this? I have no intention of shooting either government or law enforcement personnel. Is it that I may decide to, or is it that my gun might fall into the hands of someone who will? If this is the case, what is the assumption? Is it assumed that when the bad guy and the police engage in a shoot-out that both parties will miss until ten rounds are fired, giving the police the advantage of having two rounds remaining? Or is the logic one of having to draw the line somewhere? Why must this line be drawn? This concept is not without substance and reason. It is bites of the elephant taken by design, bites that will continue until the elephant is gone.

The old Lithuanian spoke words that I didn't begin to understand except in the vague light that I had the right to do as I choose where he had not. But I began to understand when I spent many months in Southeast Asia defending what I imagined to be the rights desired by those citizens: not to be subjected to a tyrannical government. I worked with unarmed Cambodians and Laotians who were subjected to horrible oppression, to the will of might. I began to understand my founding fathers and the old man's laments when friends died, or lost limbs, or disappeared trying to protect these people's rights. I began to understand when I finally saw that it is beyond the capacity of frail humans to carry forever the burden of responsibility for an entire nation with the power, the greed, the ego, and the misunderstanding of hidden agendas that are part and parcel of such offices.

The old Lithuanian, and now, similarly, an old Laotian spoke of biting and chewing on the elephant until the elephant was gone. He spoke of repression of the people, of the excuses the government made for the disarming of the people, for the slow and insidious bewilderment of the people over the issues and what they might have been versus what the government wanted them to be. Like the reduction of the Mexican people — with whom I live — by the Spanish priests to do their bidding, to control the masses through both denial of education and arms, the old man spoke of the past and the disappointments of the future in which he now found himself victim.

As a young and patriotic Green Beret in the war, I pondered over the relative and absolute meanings of the motto emblazoned across our shield: De Oppresso Liber, which was translated to us to mean: "To Free The Oppressed." And as I did, I thought of the old Lithuanian, of Hitler, of Stalin, of the war in which I found myself and which was coming to make less and less sense every day. Slowly, through thirty five years of trying to make sense of those events, through experiencing bits and pieces of them, I have come to understand. And least you find yourselves lamenting on the street with the old Lithuanian, or oppressed like the Afghans, or overpowered like those at Ruby Ridge and Waco, or subjected to the rules of a tyrannical state, you too must search into the depths of your understanding and your souls for the absolutes of the meaning of freedom in a relative and imperfect world, search below the facade of tranquil everyday America where the preponderance of, "it won't happen here" and, "we don't need such things" pervade. Just last night I watched on television as an anti-gun

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proponent told about convincing a friend, who was an elderly gentleman, that he couldn't draw his weapon as fast as a twenty year old punk anyway. Does he mean to imply that the older gentleman's freedom to choose to do so should suffer rebuke or unlawfulness? For what reasonable purpose?

I am writing this on December 29, 1995, anxious, knowing that when I wake up three days from now, another bite from the elephant will take effect. I have not applied for my concealed weapons permit yet, and realize that without it the freedom to carry my guns as I did is greatly restricted, but that with it they are as well. The police in Texas are now required to ask, when stopping a motorist, if they have a gun. The motorist may reply that they do and that they have a concealed weapons permit. However, if they do have a gun but no permit, they must show considerable evidence that it is secured in such a way that they could not possibly use it to defend themselves. If the motorist is not thought to be transporting a weapon correctly, and does not have a concealed weapons permit, that person is in violation of the law. In fact, the officer can arrest or confiscate the weapons of either type motorist. The concealed weapons permit carrier must submit two photographs and two sets of fingerprints to the police to obtain a concealed weapons permit. In the Philippines, in Burma, and in many other countries this same requirement gave their governments the knowledge it needed to locate and confiscate all privately owned weapons, to disarm the public.

The process of eating the elephant is a bite by bite exercise. It takes an interminable amount of time to change the basic fabric of a society like ours, and, like others that came before, the change is so slow and insidious that it is not always recognized for what it is until it is gone.

Think long and hard before giving up a right by just not showing up at the voting booth. Understand that it is not those whose pet laws are already on the books who flood to the polls, but those with an agenda to change them. Freedom is simply the right to make and implement reasonable choices about the quality and continuation of your life, and if you should choose not to purchase, possess, or carry a gun, you should have the right not to. It does not give government the right to coerce vulnerability upon it's citizens, nor to scoff when told that we may be setting a course to our own demise, to suffer the inequities of past human experience. Freedom to me and to the old Lithuanian, in this context, is our right to choose, to pursue, and to implement the simplest of concepts: to effectively protect ourselves and our families with a gun.

The problem is that many in the United States believe that we can rid humanity of prostitution instead of containing it, that we can put an end to crime instead of punishing it, that we can legislate the misuse of power and greed and ego. It is foolish to think so when we are all only human. And to think that we can begin this impossible change by denying the right to effectively bear arms, denying the ability to defend ourselves, is to deny our Constitution, our freedom, our American heritage, the reason we fought other governments to protect the rights of people, the same rights we now erode by legislation ... one bite at a time.

Jacob L. Gottfredson

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BUSHNELL'S LASER RANGEFINDER

THE YARDAGE PRO 800

BY JACOB GOTTFREDSON

It seems reasonable to assume that many of you, like me, are hunters, if not of big game then of varmints. If so, we might share the same problem. I feel comfortable shooting out to 250 to 300 yards, and I have the idea that I can judge that a deer or elk is within 250 yards. I generally sight my rifles in at 300 yards prior to the hunt and get after it, finding that even those assumptions are a bit suspect. I do practice using my crosshairs to subtend targets to get a better feel for range estimation. This might be better than nothing ... but not much. The problem is that deer and elk, for example, don't all seem to be built with the same dimensions.

To compound the problem, I have had a hankering lately to extend the range at which I feel that I can competently make a hit. I have rifles that I believe both myself and the rifle are capable out to 400 and 500 yards under the appropriate circumstances. However, the age old problem prevents me from doing so. I can not find a method that will assure me that the target is 375 yards Vs 425 or visa versa, for example. The bullet's trajectory path is critical at those distances. A misjudgment of the distance at these ranges will result in a miss or a wounded animal.

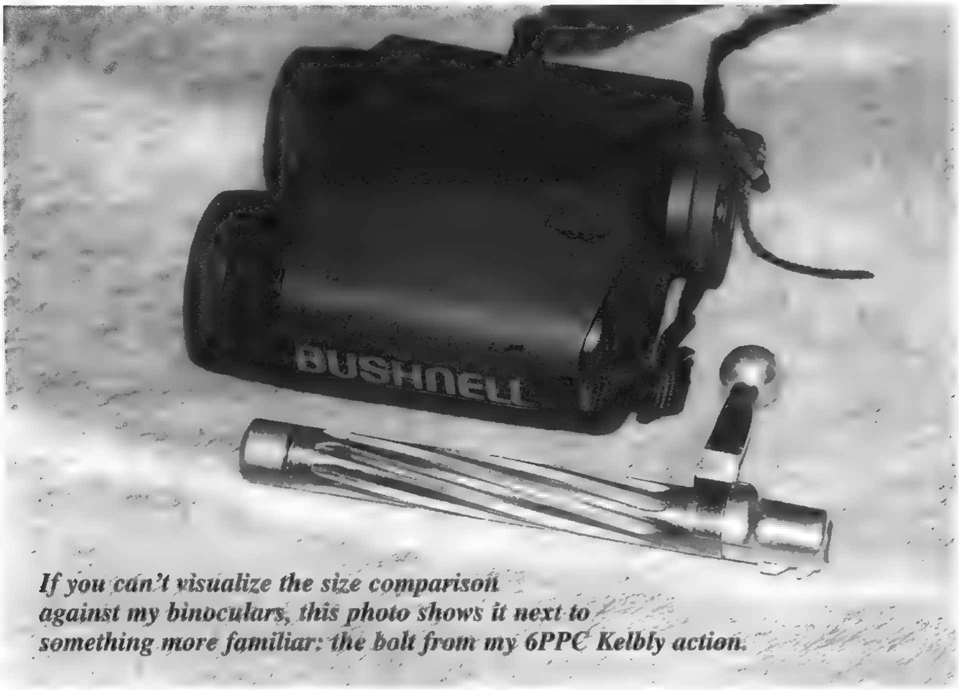
OK, I'll admit that competent methods of finding the range are out there ... if I want to mortgage my house, or spend the rest of my life searching for some military relic. I'd rather not do either. A couple of years ago I noticed Bushnell advertising a binocular-looking rangefinder that would give the distance to objects within a yard. A shooter met me at my range a few months back and placed one in my hand. I was amazed by the light weight and ability of the instrument. During those past two years I have waited patiently for Bushnell or someone else to provide one with a bit more range. When Bushnell announced the new 800 rangefinder (as did Tasco), I jumped on it.

The Bushnell Yardage Pro 800. Note the mode button on the right and the distance button at the left in the photo. The unit is shown next to a pair of Burris 10 x 50 binoculars for size comparison.

When it arrived, I was happy to see that the size and weight had not changed, or at least not gotten any larger. My unit weights just 16 ounces and is the size of a compact pair of roof prism binoculars **(see photo)**. I must confess that I am truly amazed by such technology. I know, I know, they do much more amazing things aboard jets, ships, etc.. But those are worlds from me and my understanding. At my level, I'm amazed that my VCR tape continues to eject.

If you are not familiar with the Bushnell laser rangefinder, you will see from the photo that it appears to be a binocular designed by a committee. It appears to have two lenses at one end but only one at the other. The single eye piece is a monocular through which one sights on the target, and through which a digital, back-lit, liquid crystal display is presented. The monocular is of the perma focus variety and the instrument's only weakness in my opinion. My old eyes don't seem to be on the same wave length with that particular focus. A diopter adjustment would be a great addition. The Tasco advertises such a feature. However, I did not find the fact that objects were not crystal clear to be a problem. The two lenses at the other end are the infrared devices.

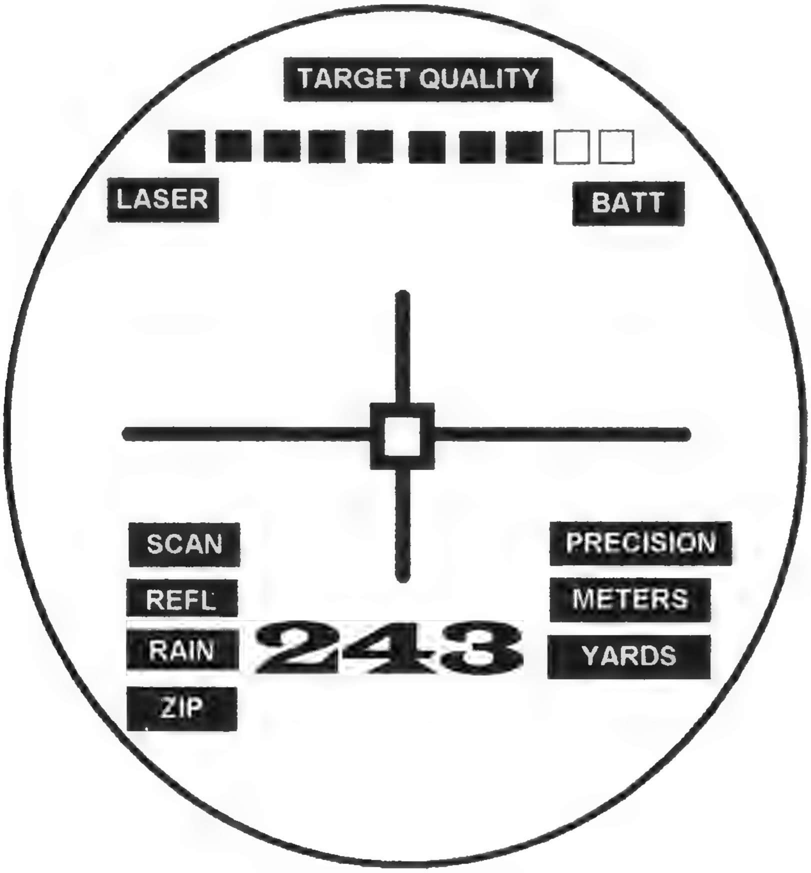
The Yardage 800 Pro has two buttons on top. These are positioned on each side so that the hands holding the tool can work them easily. The button on the left **(in the photo)** is used to change modes. Bushnell has incorporated modes that will make the rangefinder more effective when presented with objects that are highly reflective, another for times when the weather decides to throw rain, snow, or other noise into the equation **(see author's drawing).** It also has a zip function to be used when the target can only be seen through a hole in the brush, for example. In this mode the unit will not measure targets less than 115 to 165 yards away. A scan function is included that will follow a moving object, telling the user the distance continuously as the object moves. For most situations, however, the rangefinder is left on the stan-



If you can't visualize the size comparison against my binoculars, this photo shows it next to something more familiar: the bolt from my 6PPC Kelbly action.

dard function, one that I find will do most jobs. The standard function is active when none of the functions shown on the left are lit.

The button on the right (in the photo) activates the laser. Inside the monocular one is presented with a digital display when this button is pressed (see author's drawing). A series of squares are positioned across the top of the field. When the button is pressed, these begin to blacken from left to right. When they are all black, indicating acceptable target quality, the range is presented in large numbers across the bottom-center of the field that can be set to either yards or meters. The word precision will also light near the distance numbers, indicating that the distance to the target was found within +/- one yard. If the word precision does not light, the distance was found to within +/- three yards. If the distance cannot be found, the boxes on the top do not all light (a rare instance). The instrument has a square, clear box in the center of the field from which black lines run vertically and horizontally. The user places the object to be ranged in the box. This is not always easy. Hand holding the instrument on an object the size of an elk at 500 yards is no easy task. A good, steady rest is very helpful for these kinds of targets.



How Does The Yardage Pro 800 Work?

Bushnell describes the function thus, "The Yardage Pro 800 emits invisible, eyesafe, infrared energy pulses that are reflected off a selected target back to its receiving optics. Sophisticated circuitry and a high speed clock are used to instantaneously calculate distances, by measuring the time it takes for each pulse to travel from the rangefinder, to the target, and back."

When not in use, the unit turns off automatically. When you once again look through the monocular at a target, the view is clear and blank like any other telescope. You must press the right button once to turn the unit on, push it once again to range the target. After that, the distance is shown instantly in the view each time the button is pressed. This makes the unit extremely fast for ranging targets. And, by the way, the unit emits no sound. Eye relief of the Yardage Pro 800 is 25mm, and the exit pupil is 4.2mm.

How Well Does The Yardage Pro 800 Work?

I began ranging everything near my house the minute it arrived. From the street in front of my house I can see objects out to a building at the end of the street at 660 yards. The instrument would give me readings instantly, most of them without bracing the laser against anything.

I recently spent three weeks rebuilding our range. While doing so I took the opportunity to measure the distances and set the backers exactly. This was done from the bench to 100 yards in 25 yard increments and then out to 600 yards in

Continued on next page

Bushnell's Laser Rangefinder

Continued

100 yard increments. I took the rangefinder along with me the next week end and spent much of the time testing the instrument against these distances. I hung a 2 feet square, off-white target on the black backer and began ranging. The laser had no problem with this exercise, returning exact distances within much less than a second. Just for the hell of it, I would take a one yard step forward and one behind the marker. The laser was sensitive to the move, often changing the reading by a yard.

I found the instrument worked perfectly and instantly on my range (in bright sun light by the way). I then began looking for more realistic targets. My range borders the famous King Ranch, comprising approximately a million acres stocked with the equally famous Santa Gertrudis cattle as well as deer and nilgai. I only had to turn ninety degrees from my position at the firing line to see cattle at several distances. The rangefinder would post distances such as 374 yards to the first animal I found, to 573 yards to the most distant one I could see. My excitement was growing.

A downpour came just three days later, and I rushed to the safe to retrieve the rangefinder. I don't know where you are from, but here in Texas, if you want to do something in the rain, you had better hurry. The common statement here is, "if you don't like the weather, wait 10 minutes, and it will change." But I made it, and the rain stayed around awhile, varying in intensity. The rangefinder never faltered. Bushnell advertises the unit as water proof. I have noticed that Tasco advertises theirs as water resistant. I have not tested this and probably won't, but I would certainly want it to be water proof when I think back on some of the situations I have found myself in. I tried each function during the rain and the distance was found on all of them without difficulty. Maybe snow would affect it differently, requiring that the rain or zip modes be used. When in the rain mode, the unit will not measure to targets less than 65 - 95 yards.

A feature of lasers that benefits most of us is their ability to pick up the signal best in low light or overcast days. This is certainly a boon to those of us who hunt, since most animals are active in the early morning and early evening hours. Bushnell's back-lit feature provides for easy reading of the display in these conditions and even in the dark. However, I found my unit to be very efficient on bright, sunny days as well. I ranged objects of all sorts. The only difficulty seemed to be objects that were some distance away that had light brush at some distance in between the target and the instrument. I could see that the target was 400 or 500 yards away, but the instrument was telling me the object was 175 yards, for example. The problem was that the 6 power monocular was not powerful enough, or did not have the resolution to be able to see the light brush in front of me. When I realized that, I began looking for such objects as being the problem and could usually find the culprit. If I could not aim the instrument above or to the side of the obstacle, or at some object at the same apparent distance, I would have to move my position until I could get the obstacle out of the way of the laser sight.

The Bushnell Yardage Pro 800 has a three digit display and can post numbers to 999. I found that It would often post the distance to objects well beyond the 800 yard range. I ranged objects out to 900 yards on several occasions. This presented a new difficulty. Since the farther away an object is, the harder it is to hold the instrument steadily on it, I had to brace the unit. It did not have to be rock steady, but the amount of shake of the box in middle of the display had to remain within the boundary of the target. The time required for the instrument to post the distance was often longer as well. About half the time the distance to far objects was posted almost instantly, but still less than a second. About half the time, I had to hold it on the target for 3 or 4 seconds until the return signal hit the unit and posted the distance. In some rare instances I simply could not get a reading. Only one of the black boxes at the top of display would turn black, or maybe it would progress two or three boxes, but the target quality was not good enough to return a reading. My first feeling was that if it could read it, the distance shown would be right. My second feeling was that if it could not read it, the object was usually farther than I am willing or capable of shooting anyway. Out of the many objects that I have since ranged, I only remember two times when the word precision did not light up, indicating that the accuracy was almost always within the +/- one yard accuracy.

Returning to the monocular, I did find that if I looked through the middle lens of my trifocals, the image was much clearer. The position of my head for this exercise was not as comfortable, but it did work. I prefer, however, to use the rangefinder without glasses. The image is good enough for most work, ranging is quicker, and more comfortable. This is not a fault of the Bushnell Yardage Pro, but a personnel feeling about all perma focus binoculars and spotting scopes.

I have been ranging objects for about 3 weeks now with no apparent need to change the battery. The Yardage Pro takes one rectangular 1.5 volt battery. The case supplied by Bushnell is big enough to include an extra. Battery life is certainly of interest to a hunter who travels afield not expecting to return to civilization for a couple of weeks. I don't think that will be problem, given the amount of use to which I have put the unit so far.

I am excited about hunting with the Bushnell in the Rockies this Fall. The type of ridge hunting I do there, and the type of long sendero hunting I do here in the South should be ideal for the Bushnell Yardage Pro 800. I feel confident that the instrument will give me the edge I need to make hits out to the 500 yard range, all other conditions being appropriate. At least it beats the heck out of trying to subtend the target with duplex crosshairs or some other similar device. And the beauty of it is: I don't have to spend thousands to do it. The Yardage Pro 400 is priced in the $250 range while the 800 is in the $450 range (although you can find both for a bit less).

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Restoring Old BULLET MOLDS

BY GLENN R. LATHAM

I recently had the opportunity to buy four old Lyman moulds from a member of the club I belong to. They had belonged to his father-in-law, and he had inherited them. They were .38 and .44 caliber double cavity pistol moulds, and were all in need of some restoration work. They were not seriously abused, and since the price was right, I figured it was a good deal.

All four moulds had quite a bit of lead soldered to them in the usual places (bottom of the sprue plate, top of the blocks, faces of the blocks, vent grooves), as well as build-up in the cavities themselves.

This last location was one I had not encountered before. The lead had accumulated deep in the sharp corners where the bands and grooves come together. This is a location that often causes difficulty in casting, as it sometimes doesn't want to fill out. Why it would accumulate lead isn't clear, but it was there nonetheless.

The alignment pins were also loose in their mating holes in the opposite block, and some of those holes had burrs raised around them as well.

The steps I took to bring these moulds back to life may cause some to loose their appetite, but two things must be kept in mind. First, I would not do most of the things I did to these moulds to an aluminum or brass mould. They are *much* softer, and much more easily damaged. Fortunately, lead does not have an affinity for aluminum, so soldering is not a problem there, and the biggest problem with these iron moulds would not be encountered with an aluminum mould. Second, I used the tools slowly, lightly and carefully.

First I removed the sprue plates from the moulds. Most of the lead clinging to the bottom surface of the plates was removed with a single edge razor blade, held at a very shallow angle. The plates were then sanded smooth with 320 grit emery paper laid on a piece of plate glass. This will quickly show you if the plate is flat. If it is not, use coarser paper to get it flat, and finish with the 320. In place of the plate glass, a piece of ground steel or even a granite surface plate could be used. Whatever you use, make sure it is very flat!

Next the tops of the blocks were cleaned up. The razor blade was used again, and then the 320 paper. Yes, there is a sprue plate stop pin sticking up from one of the mould halves. Place the emery paper right along the edge of the glass plate and drag the blocks (held together) slowly across the paper with the pin up against the edge of the glass. Turn the blocks 90 degrees and repeat. It doesn't take much to remove the lead, which is all we want to do here. If the tops of the blocks are out of flat, they need more help than we can give them with simple hand tools.

The razor blade is used again on the faces of the blocks (where they come together) if there is any lead soldered here. Lead build-up between the faces of the blocks will hold them apart, causing oversize and out-of-round bullets. Run the razor blade over the entire face of the blocks, to check for burrs. These are not uncommon, because closing the blocks too quickly bangs them together. If any are found, removal is a necessary and delicate operation.

Most burrs will be found on the block that does not have the alignment pins protruding from it. A careful drag across the emery paper should remove them. If they are significant, a small, fine *flat* file can be used to knock them off. The file is actually safer than the emery paper, because, *if held flat on the block*, it will only cut what metal might be sticking up above the surface. When the burrs are gone, the file will just skate across the surface, as it can't get a "bite". The block with the alignment pins protruding can be cleaned up the same way, working around the pins.

One other problem will probably be found on the faces of the blocks, and that is lead in the vent grooves. This is a common problem which is caused by pouring the lead too forcefully, and forcing it into the vent grooves. Removing it is a delicate operation, and must be done with great care.

I have found no other way to accomplish this task than by careful scraping with a small, sharply pointed steel pick. As with the razor blade, lay it down at a shallow angle, and push it lightly through the groove. The lead may be really soldered in here, so if it doesn't all come out, don't sweat it. Some early bullet moulds were made with no vent grooves at all, and they cast good bullets just fine, thank you very much. The air in the cavity doesn't usually seem to need a whole lot of room to escape.

At this point, these old moulds were all cleaned up except for the lead in the cavities themselves. As I mentioned, this was a new problem for me, and I approached the solution with fear and perspiration. I first tried a brass tooth brush, but it didn't touch it. I then held one of the blocks under a lighted magnifier, and carefully, *gently* picked at some of the offending lead in the cavity with the steel pick. A small sliver of lead emerged, though not all of it. Encouraged, I proceeded to carefully, *slowly* pick the major portions of the lead out of the corners of the cavities. Without the lighted magnifying lamp, I don't think I would have attempted it.

Small amounts of lead were still soldered in the deep recesses of the cavities, but before removing it, it was necessary to do some adjusting to the blocks themselves. As is the case with most moulds which have seen a little use, the alignment pins no longer fit closely in their corresponding holes in the opposite block. Holding the mould closed with one block

Continued on next page

Restoring Old Bullet Molds

Continued

half in each hand, twisting the blocks caused a clicking sound, there was so much play. I then pulled the mould apart, and by turning the blocks approximately 90 degrees, could try each pin in its mating hole individually. Both proved to be loose.

To tighten the pins back up, place the closed mould on its side on a hard (preferably steel) surface with the block containing the pins on top. Take a proper sized punch (5/32" for these Lyman moulds), and tap one of the pins in a little deeper. Pick up the mould and put it together so only the pin you just adjusted is in its mating hole, and check for looseness. In my experience, the pins are quite tight, and it takes a pretty stiff rap to move them. Continue to tap and try until the pin fits perfectly into its mating hole, then do the other one. If you move a pin too far, just tap it back with the face of the hammer, but be careful here, as you're working right over the exposed cavity of the mould!

Tightening up the pins will remove most of the out-of-roundness condition of the bullets, but a certain amount of out-of-roundness (.001"-.002") can be expected in mass produced, cherry-cut moulds. It might be possible to reduce the out-of-roundness by loosening one alignment pin and tightening the other. This would work if the holes were not perfectly lined up when the cavities were cut. (I know one fellow who bought five or six moulds of the exact same design and mixed and matched the mould halves until he found a pair that cast round bullets. I guess it was worth it, as he set a 200 yard cast bullet benchrest group record with those bullets!)

The only way I could come up with to remove the remainder of the lead stuck in the cavities was lapping, a trick I had read about a number of times but had never tried. The lead pot was fired up, and a few sets of bullets were cast in each mould until it became warm enough to cast good, but not perfect bullets. The last set of bullets in each mould were left in the cavities.

I then removed one bullet and drilled almost all the way through it from the base with a #21 drill and then ran a 10-32 tap into the hole. The tap was left stuck in the bullet, and a very small amount of fine valve grinding compound was applied down the center of the cavity in both halves of the block with a toothpick. The bullet was laid back in its cavity, and the blocks closed carefully around it.

I then placed the mould in the bench vise (to hold it closed and attempted to turn the bullet with a tap wrench on the tap. It wouldn't budge. I took the mould out of the vise and just held it closed in my left hand and turned the tap with my right. The bullet turned with some difficulty at first, but began to loosen up. I gave it a few twists in each direction and then opened the mould.

A small amount of compound had gotten on the block faces, so this was removed so the blocks would close completely. The bullet was also lightly wiped with a paper towel to remove excess compound, and placed back in the cavity. The mould was once again placed in the vise, and I was now able to turn the bullet with some difficulty. A half a dozen turns in each direction were taken, then the mould was removed from the vise and inspected.

The bluing had been removed from the cavities, and it appeared the offending lead had been removed as well. I repeated the steps for the remaining cavities in all four moulds, and then cleaned them with carburetor cleaner. After the moulds were dry, the cavities were cleaned with denatured alcohol on a cotton swab. Close inspection under the lighted magnifier proved I had been successful.

The only thing that remained to put these moulds back in working order was to prepare the cavities for casting. Most casters agree that the cavities of a steel mould should be heat blued before using. This can be done several different ways. I first tried using my propane torch, but the bottle was almost empty, and the flame was rather anemic. About all I accomplished was to turn the cavities from silver to yellow. I mounted the other blocks to mould handles and stuck the blocks about 1/2" deep in molten lead (about 780°, as hot as my pot will go). In little more than a minute, the cavities were nicely blued.

Besides bluing, it is often helpful to apply a coating to the cavities to enhance fillout. I have used the oldest method, soot from either a candle or a match for years with satisfaction. NEI markets a product called Mold Prep, which is basically graphite in an alcohol carrier, which works quite well, especially on aluminum moulds. A friend recently told me he likes to treat his iron moulds with Mould Prep. He takes a Q-Tip and dips one end in Mould Prep, and the other end in denatured alcohol. He then applies Mold Prep to the cavity and immediately flips the Q-Tip around and wipes the Mold Prep out with the denatured alcohol. This apparently leaves just enough Mold Prep in the cavity to enhance casting.

My buddy apparently forgot he was giving advice to someone who, on occasion, doesn't pay as close attention to everything he's doing as he should. I wetted the two ends of the Q-Tip with the proper substances, wiped one cavity with Mold-Prep, flipped the Q-Tip around and wiped out the cavity with the alcohol. It was only after I was done that I realized I had, after flipping the Q-Tip around, done a perfect job of applying Mold-Prep to my hand as well!

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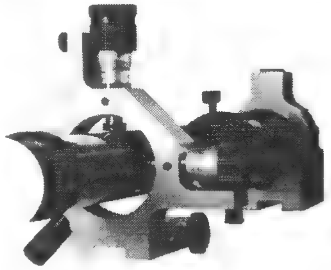

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Since I had four similar moulds to work with, I decided to do some experimenting with various cavity preparations. In one of the .38 moulds and the only .44 mould, I applied Mold Prep as mentioned above to one cavity, and smoked the other one.

I tried casting bullets with the .38 mould first. The alloy was a 50-50 mix of wheel weights and pure lead, heated to 780°. I started casting with a cold mould, and of course both cavities yielded wrinkled bullets. As the mould warmed up, the smoked cavity began to cast perfect bullets, while the Mold Prep treated cavity continued to drop wrinkled bullets.

This was in what I refer to as the low temperature good casting range. I have found, at least with wheel weight metal or this 50-50 mix, that a mould will cast good, shiny bullets shortly after casting begins, but if the pace is sufficient, the mould will, as it heats up further, begin to cast bullets that have frosty spots, usually on the bands, which are rounded, or not completely filled out. If the casting continues to heat the mould even more, the bullets will begin to come out evenly frosted, and perfectly filled out. This I refer to as the high temperature good range.

When the Mold Prep treated cavity refused to cast good bullets in the low temperature range, I smoked it and it began to cast good bullets immediately.

I then took the identically treated .44 caliber mould and began to cast with it. The results were the same in the low temperature good range, but I continued casting, and when I reached the high temperature good range, both cavities began casting good bullets at the same time. I set the mould aside to let it cool, and then started casting with it again. The bullets from the Mold Prep treated cavity were more wrinkled than those from the smoked cavity when the mould was too cold, but both cavities began casting perfect bullets at the same time.

I took the second .38 mould and applied Mold Prep to one cavity, and did not wipe it out with alcohol, and smoked the second cavity. The casting results were the same as with the first two moulds, i.e. leaving the Mold Prep in as applied or wiping it out with alcohol did not make any difference.

The last .38 mould was the one with the "yellow" cavities from the weak propane torch flame. One cavity was smoked, while the other was left bare. However, I dipped a corner of the mould blocks in the molten lead for 10 seconds before smoking the one cavity, and then dipped it for another 15 seconds after smoking and then began casting. The first bullets were pretty good, and it only took three to four cycles to begin producing perfect bullets. After approximately 25 casting cycles, the cavities were noticeably blued. It appeared dipping the corner of the mould in the molten lead raised the block temperatures just about to the upper good temperature range, as only a few casting cycles were required to "even out" the temperature and produce perfect upper temperature range bullets.

Well, after all this, do the moulds cast good, round bullets? One .38 mould casts bullets from .361"-.3625", a bit large and a bit out-of-round. Another casts .3575"-.3595", better for size but still out-of-round a bit. The third .38 mould casts almost perfect bullets at .359"-.3595". The .44 mould casts bullets .4585"-.4595", pretty round but a bit smaller than I usually prefer. All the bullets come out perfectly filled out, nice and sharp. The out-of-roundness is found when measuring immediately on either side of the parting lines, a result of imperfect block alignment. I believe these moulds cast bullets as good as when they were new, and the out-of-roundness, if consistent (i.e. the alignment pins are snug) will not adversely affect accuracy.

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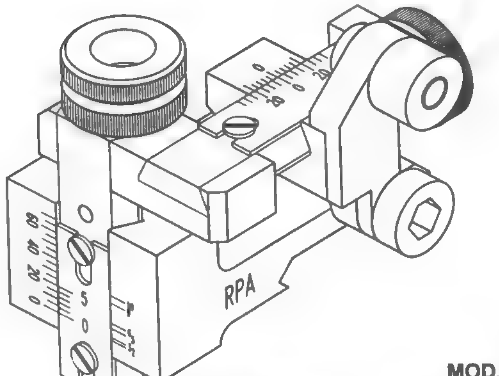

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SMALLBORE RIFLES I'VE KNOWN

BY BILL SCHERTZ

My first exposure to rimfire benchrest was in 1995, when I competed in a local IR50/50 competition in Pontiac, IL. I'd shot smallbore rifles since 1963 in prone, position and silhouette competitions, but this was something new. For once I didn't have to attempt to hold the rifle motionless while squeezing the trigger as I did for the other disciplines. In that sense shooting from the bench was much easier, but easier ends quickly once you see the size of the target. The IR50/50 target is very demanding to say the least and anyone who has fired a perfect 250X250 score can well be proud of what they have accomplished. I'm still hopeful my day will come.

The first rimfire rifle I shot in competition was a Stevens 417 commercial version of the government training rifle. It came out of my father's gun cabinet and after 2 frustrating years I put it back in his gun cabinet. In spite of having an excellent Stevens X-ring barrel and finding and fitting a reasonable looking prone stock to the rifle, the trigger was so unpredictable that I considered forgetting the whole idea of competitive shooting.

I'm one of the unfortunate people that does everything right handed except shoot, because my left eye is my master eye. As luck would have it, the only other local shooter that was actively competing on the prone circuit was Gene Stamm and he was also left handed. Gene had 3 BSA left-handed target rifles, two mark III International's and one custom built Mark I. I would drool over any of the three every time I saw them. This was in the middle 1960's when left hand bolt rifles in smallbore were non-existent and the BSA's imported by Al Freeland were the left-hander's dream gun. It took me one shooting season to finally pry loose one of the BSA Mark III International's from Gene. The first time I beat him with it he offered to buy it back at a premium. Even though the rifle weighed in at over 15 pounds with the scope, I was young enough and strong enough to hold it up and shoot prone with some degree of accomplishment. I still have a 10 shot 100 yard target shot with this rifle that measures just under one inch. No question it would shoot, but the weight began to be a burden. I suspect the bursitis I notice in my right elbow from time to time is directly attributable to this beast, and I stopped shooting it 25 years ago!

In 1971 Anschutz came out with the 1407 Standard Rifle (a Match 54 action with light weight barrel). I ordered the left hand stock but had no choice except the right hand bolt. With iron sights it was well under 11 pounds and seemed as light as a toy compared to the BSA. The rifle shot extremely well right out of the box and although it was not as easy to cycle the bolt and stay in position as the BSA under-lever was, the weight reduction was well worth the trade off.

Ten years later Anschutz came out with the 1807 Standard Rifle (same 54 action with improved trigger and bolt mechanism) and offered it in true left hand version. I had to have it and had expectations that it would also shoot terrific out of the box. Unfortunately that was not the case. With 5 different makes of match grade ammo the best I had to show was a nice round 10 shot group that measured two inches at 100 yards. I had several discussions with the importer but to no avail and decided to have the barrel re-crowned to see if that might help. No change, still slightly over 2 inch groups was the best it would produce.

In desperation I decided to take the good barrel off the old 1407 and put it on the new left hand 1807 action. Jack Foster at Accuracy International accomplished this task for me and at the time he was one of the few gunsmiths around with Anschutz oversize taper pins needed to pin this barrel in place like the original factory connection. The results were as I hoped, the barrel continued to shoot very well and I had the luxury of using the bolt handle on the left side.

Prone shooters have always been extremely sensitive when it comes to triggers. The Kenyon trigger is widely known as one of the best and I was fortunate enough to be able to purchase one from a local shooter who was getting out of the game. There are few things in this world that don't change or deteriorate over time, but the Kenyon trigger is one of them. You can set this trigger for a specific weight from 2 ounces to 2 pounds and it will pull that same weight 5 years from now. There is absolutely no discernible movement of the trigger shoe in the course of firing a shot. It is best described as a pressure trigger, when you exert sufficient pressure to permit the sear to fall, the shot is gone. It is the finest trigger I've ever squeezed.

Another 10 years down the road (now 1991) I got the feeling the 20 year old barrel may be losing its edge. I had shot numerous cases of ammo through it and some of it was Winchester/Western Mark III Super Match that was notorious for producing a ring in the barrel ahead of the chamber. This ring could be seen with the naked eye and would start at 6 o'clock and could go completely around the barrel just ahead of the chamber in a really bad example. Being so impressed with the workmanship of my Kenyon trigger, I decided to send the rifle to Karl in Ely, Nevada for examination. He called a few days later and was very confident that cutting off the chamber 7/8" and setting it back would help to restore the original accuracy. He wanted to sweat solder it back in place after cutting a new chamber and said he would also square up the bolt face and harden it.

One of the tests Karl does is to slug the barrel, ie; pull the lead bullet off a match round and push it through the bore ahead of a cleaning rod. (Probably best not to try this at home.) With Karl's years of experience he can feel any thin spots in the rifling, check for scratch marks on the

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lead and then make a determination about the future of a barrel. He indicated my barrel felt fine except for the Mark III ring, but it had the typical Anschutz choke at the muzzle, where the inside barrel dimension actually reduces slightly. This is probably the result of the external knob the Anschutz barrels have. If you push your cleaning rod with a snug patch through the bore of your Anschutz you can actually notice it get tighter just before your patch exits the muzzle. Karl indicated most of these barrels will shoot better if you remove that choke by counter-boring an inch or more into the muzzle and re-crowning it. I gave him the go ahead and wasn't too put off when the finished product came back looking like a 20 gauge shotgun from the muzzle.

The results were exciting. I felt the barrel was shooting better than it had ever had and in 1992 I won both the Illinois and Indiana State prone championships with this rifle. On day 2 at the Indiana match I shot my first perfect score of 1600-125X.

Along with my prone shooting of the 1980's, I also shot smallbore silhouette competition. Rather than buy something else, I used what I had and fitted my 1807/1407 in a Fajen silhouette stock. This combination worked well and for several years I would switch the barreled action from the prone stock to the silhouette stock and vice versa with good results. In 1993 I was lucky enough to win the Illinois State Silhouette championship with this same rifle.

In the spring of 1995 I had my barrel frozen by 300 Below in Decatur, Illinois. The smallest 10 shot group at 100 yards this rifle ever produced in 24 years was .875" from the bench. I was anxious to do some testing when I got back to see if there was any noticeable improvement. Within the first 5 groups it produced a .625" 10 shot 100 yard group with the same lot of Ely Benchrest Gold that produced the .875" pre-freeze. Unfortunately, I've expended all of that excellent lot number (WS1161), but I'm convinced of the accuracy enhancing results of 300 Below's treatment. They were also kind enough to give me a tour of their facility and the opportunity to see the process. It was neat.

Like most new competitors to smallbore benchrest, I used what I had in getting started. I made a 3" X 6" Plexiglas skid plate that fastened to the Anschutz accessory rail to gain a flat area to ride the front sand bag. By removing the after market adjustable butt plate and my home-made adjustable cheek piece, the rifle with Leopold BR24 scope weighed in at 10 pounds 3 ounces, qualifying it for both 10.5 and 13.5 pound classes in IR50/50 competition. I've used this arrangement the past two years with fairly good results, including a world record target at 50 meters last summer in the Illinois State championship. That old barrel is a keeper!

Last winter I broke down and ordered a MacMillan BR50 stock to fit my 1807/1407 barreled action. I don't know that it shoots any better, but it looks more like a bench gun now. I specified exactly the measurements I wanted in the stock including the finished weight and that is exactly how it came back. They make a very nice product that is well worth the price.

Smallbore benchrest competition like everything else, seems to get more competitive every year. I've noticed the Blackstar barrels are producing some fine results and I'm beginning to wonder if my old barrel would benefit from their treatment. I talked to Greg at Blackstar the other day and he offered to do an inspection process on my barrel before preceding, and then he could better advise me if it would be worthwhile.

Does anyone know how long a good smallbore barrel will last?

Bill Schertz

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Rebarreling the M-1A and Double Stress Relieving

BY ROY BAUMGARDNER ©

The new heavier barrel tends to hold better in the offhand, standing position.

The M-1A had a standard weight National Match barrel on it, and I was told that it was a Douglas. However, upon removing the top hand guard, it was found to look more like a buggy whip than a serious 1000 yard hole poking, target shooting machine. For anyone used to heavy barreled rifles, that is.

In spite of it's thin looks, though, it did very well over the National Match course of 200, 300, and 600 yards, logging in some very good groups and scores. It also did very well in the Palma at 800, 900, and 1000 yards. So looks are not everything.

There was a time at Perry however, when it was fired with a new load at 1000 yards, and did fine, then on the very next day, with only the boat tail of the bullet changed, and everything including a really boiling mirage, looking exactly the same, when it could not be gotten on the target at all with 180 grainers.

My good buddy, Hank, was scoring, and he can almost always watch from behind the rifle with a good spotting scope, and find where they are landing, and direct the sight settings on to the target. This time though, nothing worked. We tried bracketing the target, going out farther, and farther, then coming back in, and starting all over again. On his suggestion, it was fired at the base of the target number board, only to have it's trace vanish into the mirage like a bullet into a fog bank. The frustration grew and grew. By now, the match was lost, but we still did not know what was wrong, so I kept shooting. Welcome to Perry and 1000 yards, where often nothing makes any sense at all. Finally, he leaned over and said "Fire at the 600 yard line". This was promptly done. There was a silence as he gazed through the scope intently for a few moments, then he threw both if his hands in the air and yelled in desperation, "I give up, you can't even hit the planet you're laying on!" The crowd loved it. That load, which I have a strong hunch was going sub sonic in the last hundred yards or so, was never used again, and the problem never came back again. All in all, this was a very good over-the-counter rifle for service rifle matches (the problems of this particular day notwithstanding).

Finally, it was decided to make a winter project out of building a real heavy barrel for it, so when Boots Obermeyer was called to order a heavy stainless blank for the AR-15 project, a 1 in 10 twist .30 caliber was ordered as well.

Boots cuts his rifling, and also makes his bore diameter a bit smaller. The barrel (stainless) received was stamped .298-.308 on its end. This sat until a break came in the AR-15 and .243-06 projects, and about at the same time, a letter was received from Bob Brunson, of 300 Below Inc., which was quite interesting. 300 Below, of Decatur, Illinois (217) 423-3070 is described briefly in the heavy barreled, 80 grain AR-15 project, but some of the more important information will be repeated here in case it was missed.

Basically, what 300 Below does is freeze rifle barrels, race car motor parts, and industrial tools like taps and dies to stress relieve them. They of course do many other things as well.

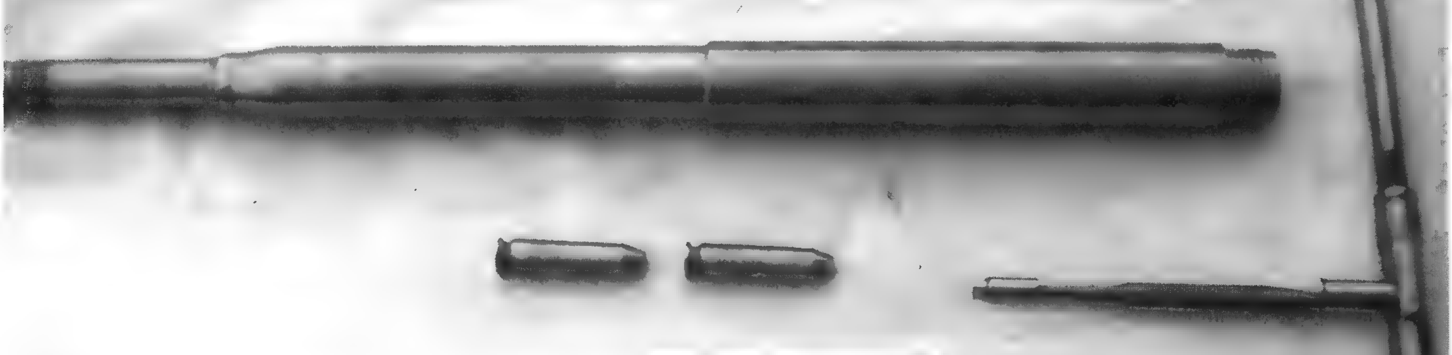
It is known that rifle barrels or similar bar stock item can walk all over heck due to internal stress, and drilling a hole lengthwise through a barrel blank for the bore, and having it come out the other end exactly in it's center is not always a walk in the park.

Generally, any removing of metal from a rifle barrel, especially on it's outside diameter, will cause the stresses in it to change it's vibration pattern. Which is just one of the reasons that heavy barrels on target rifles are usually more accurate than skinny ones on over-the-counter hunting rifles.

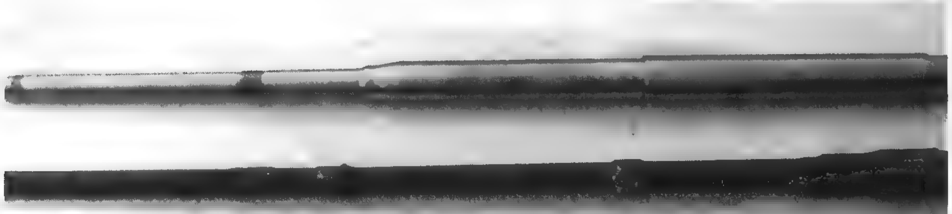
Most custom barrel makers go to great lengths to deliver the best, and most stress free barrel possible, and my hat goes off to them for the fine work that they do.

Always bring an experimenter at heart, however, when it was initially learned through the pages of Precision Shooting, of the results that Geza Nagy and George Kelby had gotten through freezing barrels, it was decided to call Bob Brunson and get involved.

The idea being that the .30 caliber M-1A barrel in it's blank form (that is, unchambered, unthreaded, and unfinished) would be sent to Bob for a first treatment, he would then return it, it would be finished completely and fitted to the rifle. Then taken off and sent back



The new fat barrel with Dave Manson's go, nogo, headspace gages and chambering reamers.



The new fat and heavy stainless barrel beside the standard weight match barrel. Some of the skinny ones do surprisingly very well.

to him for a second treatment. It would then be refitted to the rifle and break in and testing begun.

When this was discussed with Bob, he felt it was well worth doing. By the way the price in his literature (per treatment) was $49.50 plus $9.00 return shipping as of this point in time. It was thought that any stresses induced during the machining and turning could, in thisway, be relieved.

I then called Boots and we discussed this, and he felt it was worth playing with.

The next call was to Dave Manson of Clymer Manufacturing to get a chamber reamer and "Go" and "No Go" headspace gages, and he also felt we were on the right track, and had parts to us in fine time, just like he always does.

The barrel was shipped, and when returned, started on right away. The first thing noticed, and I thought that it was my imagination at the time, was that the stainless metal machined a bit smoother with the carboloy tools used, than other barrels that we had done. This also proved to be the case with the high speed steel tools.

Since Dave and I had decided to throat for Sierra's 168 grain Match bullet in a match chamber, for the rifle is to be used at 200, 300, and 600 yards, it was also believed that it would do all right at 800, 900, and 1000 yards with Walt Berger's 185 grain VLD's with some special attention given to his 175 grainers, as these are somewhat close to being a modern version of the Government's 173 Match bullet which was proven to be the best in trials many years ago, and should be a bit easier on the bedding of the rifle with the max loads used at the very long ranges.

So I called Berger's to get some, and Stephen answered the phone as he always does, and we chatted for a while. I sometimes wonder if Walt always lets him get on the phone first cause, (1) He is always busy, or (2) If an alien abduction team calls, they will encounter Steve first, Anyway, Walt got on and we discussed the project. He also thought it was well worthwhile, and when the smoother machining was brought up, felt that it could well be, so as he had had some experience somewhat along the same lines. This is not to say that the tools do not get dull like they always do when cutting, it is just seems that they cut smoother.

Along these lines, another thing occurred which is well worth passing on,

Continued on next page

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The new barrel being turned in the lathe after it's first stress relieving at 300° Below.

The M-1A with its heavy barrel, held by my older brother. This is the same guy who shot my grandmother's radio when we were kids. But the dogs all love him. See the 1995 Precision Shooting Annual for more on this.

Rebarreling the M-1A
Continued

if it's not known about already. When I started cutting the chamber with Dave's reamer, by hand, in the lathe with the power off, as this is my favorite, very slow way, I began to experience reamer cutting chatter marks. This is not new of course, especially with a new reamer, but what was new, was that none of the normal machinists tricks to combat this worked. So I stopped and called Dave. He came up with one that worked like a charm. a 100% cotton .30 caliber cleaning patch (purchased from Champions Choice of Nashville, Tennessee, while at Perry) has a hole poked through it's center with a center punch. This is slipped over the front of the reamer, and the reamer, swabbed with cutting oil, is put back in the chamber. The lathe is run at about 800 r.p.m. and the chatter disappears.

What happens, explained Dave, is the patch cushions the first cuts of the reamer to where they just trim the top off the previous chatter marks, which is normally prolong the chatter, while the rest of it is wedged between the flutes where it dampens the chatter. (Slick!) The chatter may, or may not return after the patch is removed. In my case, it did not return, and I could cut a half a thousandths anytime after with an excellent finish.

This barrel was made as fat and heavy as it could be made and still get it into the stock. This made it necessary to make a new oversize operating rod guide that would barely fit into the relieved stock. This was made with a thumb press fit on to the barrel, which allowed it to be moved from side to side until an absolute free and neutral sliding fit could be adjusted into the operating rod and bolt assembly to where there was no tension, or pressure on their travel that would disturb the barrel's harmonic vibrations before the bullet left the bore on firing. This is somewhat similar to adjusting the operating rod on the M-1 Garand. The operating rod guide was then locked in place with set screws.

The rifle was finished, rebedded with Brownell's Steel-Bed. (the locking lugs and bolt face had been squared), and was then broken in per Boot's instructions. It was found, not surprisingly, to have a love affair with Sierra's 168 grain match with 40 to 41 grains of H-4895 behind it in a Lake City Match case. These normally give one minute of angle or less groups off a bench at 200 yards. A couple of mid-afternoon tests at 600 yards at the Malvern, Ohio range in so-so wind conditions gave 5" to 7" groups. Again, from the benchrest position.

The rifle was then taken to Camp Perry, not far from where I live, and tried in an Ohio State Match at 1000 yards, using neck sized, and shoulder bumped back, fire formed cases with Berger's 185 grain very low drag bullets. These had worked well in tests at 200, and 600 yards, again using H-4895

The M-1A with it's heavy, stainless, double cryo stress relieved Obermeyer barrel. The entire project continues to be well worth the effect.

powder. Just before leaving for this match-test session, we ran low on the H-4895. A quick call was made to Kent and Paula Radcliff at Powder Valley Services in Dexter, Kansas, on their very friendly 1-800-227-4299 phone line, and more was soon there. This really helped.

The 185 VLD's proved to be both accurate, and very flat shooting at 1000 yards, requiring 6 to 8 minutes of elevation less than the standard 173 grain Government Match load, and at first we had some trouble getting on the target until a low shot just nipped the top of the frame, and we found we were shooting over it, but were dead center on for windage.

At the Camp Perry Nationals in August of '95, the rifle was fired in the service rifle class of the Palma Individual Match at 800, 900, and 1000 yards. I drew Dave Gifford, of Canton, Georgia for a partner, and it turned out that he knew friend Doug Randall (Sharps and Swifts) and we had a ball shooting that match. I came in about the middle of the pack, which is normal for me.

I am convinced that double stress relieving is well worth the effort and cost, it you start out with a high quality barrel to begin with. Another plus is that this rifle shows absolutely no shift in zero during a 20 to 30 shot firing string. Many rifles, especially service rifles, tend to do this as their barrel temperatures rise, particularly on a very hot day.

There is also the consideration that stress relieving by deep freezing should lengthen barrel life by changing it's molecular structure. It feels very good to get a fine barrel and know that it should last for a while.

Bear in mind though, that if a high quality barrel is not chambered to perfect concentricity with the bore, the correct loads not used, or any of a dozen other things that you and your gunsmith are supposed to do, are not done correctly, all of the deep freezing in the world will not make it shoot better.

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Lapping in the Bolt Face & Locking Lugs on the M-1, M-1A

BY ROY BAUMGARDNER©

Lapping in the bolt's locking lugs and bolt face to a true fit in the action is nothing new, as the bench people have been doing it for quite a few years now, as it does indeed improve accuracy.

It is surprising though, how often this is overlooked, or just simply dismissed as not really being all that necessary when building or rebarreling a service rifle for match target use, or just to improve the accuracy, when rebarreling.

Where the error of their thinking comes back to haunt these people is that while normal commercial hunting rifles are not held to the close tolerances of a bench rest competition rifle, service rifles made during the haste of wartime, which is when the really big production runs are made, can have tolerances on these parts that are very generous indeed.

Due to their design, the M-16, AR-15 family of service rifles does not suffer as badly from this as the M-1, M-14 do.

This is not to say that the rifles coming from Springfield are not good, because they are, and they are very good for an over-the-counter match target Service rifle.

However, most precision gunsmiths feel that any rifle can be improved by lapping the bolt lugs and face to a true fit, and extremely close tolerances.

The problem with the M-1 type of bolt is that while the locking lugs are at the front, which is where they should be, all the rest of it as it extends to the rear, is pretty loosely supported in the action's rails. This, as a rule, allows the rear of the bolt to move about, usually in an up and down direction, quite a bit, when locked closed, compared to a close fitting target rifle's bolt. This generous up and down movement at the rear translates into a slanting of the bolt's face where it bears against and supports the base of the cartridge case.

Often, when the barrel is removed from the action on an M-1, it is found that it can be difficult to get a truly precise reading around the area of the face of the bolt, when using a depth micrometer from the face of the action.

The bolt's design is not all bad, however, for either a quirk of fate, or Mr. Garand's thinking, provided for part of a cure for the problem of the loose up and down play.

What happens is that the magazine follower of both the M-1 and M-14 bear against the bottom of the bolt when it is in its closed (battery) position, and this tends to have it return to close to the same position each time it is cycled. More on this later.

That only makes for a partial cure, however, for if the bolt's lugs do not bear evenly and squarely against the action's locking surfaces, the bolt will take the path of least resistance and shift in that direction as it travels rearward from the thrust of the cartridge being fired, against the face of the bolt. This, of course, tends to cock the bolt up or down or sideways, or whichever way it can go. This does not tend to give good accuracy. If, however, the bolt's locking lugs and face are lapped square, most of this unwanted motion can be eliminated.

If the rifle has been shot a lot, it will often be found that the rearward thrust of unlocking during the extraction cycle will have tended to seat the locking lugs of the bolt to start with. This will not, however, cure a slanted bolt face, and may in some cases even make it worse.

Various armorers and gunsmiths have come up with ways to lap in these parts. The methods that they use, and the reasons that they give for them are indeed interesting.

All will tell you straight off that it is not wise to try to lap the locking lugs by using the operating rod (bolt handle) to rub them up and down against each other. For it is almost impossible to keep the lapping compound from getting into the cam opening parts, and you certainly do not want it there.

Some cut off an old barrel about two inches in front of the chamber, then drill the bore out to accept a five inch long, half inch diameter shaft of mild steel. The end of this shaft is turned down to just fit the face of the stripped bolt.

This barrel stub is then screwed into the action in place of the barrel, and the half inch shaft runs down through it until it locates in the face of the closed, stripped bolt. This forms an axle which supports the front of the bolt during the lapping of the bolt's locking lugs, and later is used to square the bolt's face, which is also done by lapping.

Now from here on in, it really gets interesting, as some of these smiths will refuse to use an old G.I. barrel that does not fit the acme threads in the action very snugly.

These people true up the face of the action and the internal threads the same way a bench rest action is done. They then make a barrel stub that just fits the action snugly, with careful attention placed on getting the shoulder that locates on the front of the action perfectly straight and square. They also ream the half inch bore so that it will be a very precise fit to the shaft. Nor does it end there, for if at anytime during the lapping process on the face of the bolt, they think

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that the face end of the shaft is wearing in to fit the slanted bolt's face, they take it over to the lathe and machine it square again. This tends to keep everything sharp and square during the whole lapping- in process, and is one reason that some of them prefer mild steel for the shaft rather than soft lead bronze. They maintain that hard steel, although it stays square longer, does not let the grit embed in its face as well, and hence does not make as good a lapping tool. The bronze lets the grit imbed easier, but does not hold its squareness as long. All very interesting from an accuracy nut's point of view.

There is, however, even more motive to their madness. Since it is desired that the bolt move only backwards, in an absolutely straight line, if at all, when fired, the rear of the bolt is held up against the bottom of the top of the action during all of the lapping operations. This, plus the shaft in the face of the bolt forming a supporting axis, should ensure that the bolt faces are made flat and square, eliminating any round surfaces that would allow the rear of the bolt to move up or down.

The way that some of them hold the action during the lapping, to get exactly what they want, is also interesting.

One fits the barrel stub and shaft, then inserts a 9/64 Allen wrench in the hole in the bolt that holds the extractor. This gives him a small handle to work the bolt with while lapping (slick). He then holds the end of the shaft up against his chest, and with the action turned upside down, presses the bottom rear of the bolt into contact with the inside of the top of the action with his left thumb, while his right hand works the little Allen wrench handle up and down to do the lapping. This takes care of the locking lugs very nicely.

To do the bolt's face, the action is held barrel stub up, with the rear of the action resting on a table, or held in the padded jaws of a vise. The left hand goes around the action, with the thumb pressing down and to the rear on the roller of an M-14, M-1A, or the stub that opens and closes the bolt of an M-1. The reason for the downward, rearward, light pressure is to ensure that the new square locking lugs stay in perfect contact with the action's lugs as the shaft is rotated back and forth, which tends to open the bolt. And they do not want the bolt to come open.

At the same time the left thumb holds the front of the bolt, the other fingers of that hand press the bolt's bottom upward, into contact with the inside of the top of the action. The right hand then rotates the shaft back and forth. These operations can also be performed left handed and simple rubber bands can be used to help hold things in place while at the same time applying pressure where needed.

Lapping compounds come in almost any grit size, but most armorers suggest that you start off with a medium grit, such as the valve grinding compound used to lap in automobile valves. Then they finish up with a fine grit. Many of these are in water based paste form and are very easy to use. Cleanup after the lapping in, is also easy, requiring only hot soapy water, followed by relubrication of the parts. Permatex, a division of the Loctite Corporation, makes a good lapping compound, which is available at automotive stores.

Normally, the only time you lap in locking lugs, or the bolt's face, is when you fit a new barrel with a new chamber. For if you did it to a rifle already headspaced and in use, it could well make the headspace bigger and out of tolerance. This could be dangerous. But it is always interesting to know how other gunsmiths and armorers arrive at the accuracy that they get.

Also, it is very important that the locking lugs be lapped in first, before the bolt face is done. This is to get everything square and true here first, and then the bolt's face is ground in to match this. It must be done in this order.

One other little gem of wisdom is worth sharing. Anytime an M-14 or M-1A is fired, it should have its magazine in place in the rifle so that its magazine follower, or the cartridges on top of it, push up against the bottom rear of the bolt. Failure to do this will allow gravity to pull the rear of the bolt downwards, which slants the face of the bolt in relation to the cartridge's base. If the lugs have been lapped square, the rearward thrust of firing will drive the rear of the bolt back upwards again, causing a radius to be formed on the lugs. This is not the end of the world, it is just taking away some of the square surface you worked so long to get. The M-1 of course, does not suffer from this at all, as its follower is always in the rifle.

As in any modification, a good gunsmith should be sought out first.

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Palma Shooting On the Move

The '97 Sloughhouse-British Columbia Long Range Rife Matches

BY JOHN DUSTIN

Back in '94, Stan Covington and I were looking for a place to do some long range shooting, up to 1000 yards. With no suitable ranges in the Bay Area, we looked at other opportunities in northern California, eventually settling on Folsom Shooting Club's range, known as the Sacramento Valley Shooting Center. This excellent facility offers a full spectrum of shooting opportunities, from shotgun, pistol and silhouette layouts to benchrest setups (up to 300 yards) and a 1000 yard highpower range. It is located about a half-hour's drive east of Sacramento, on rolling grasslands near the foothills of the Sierra Nevada.

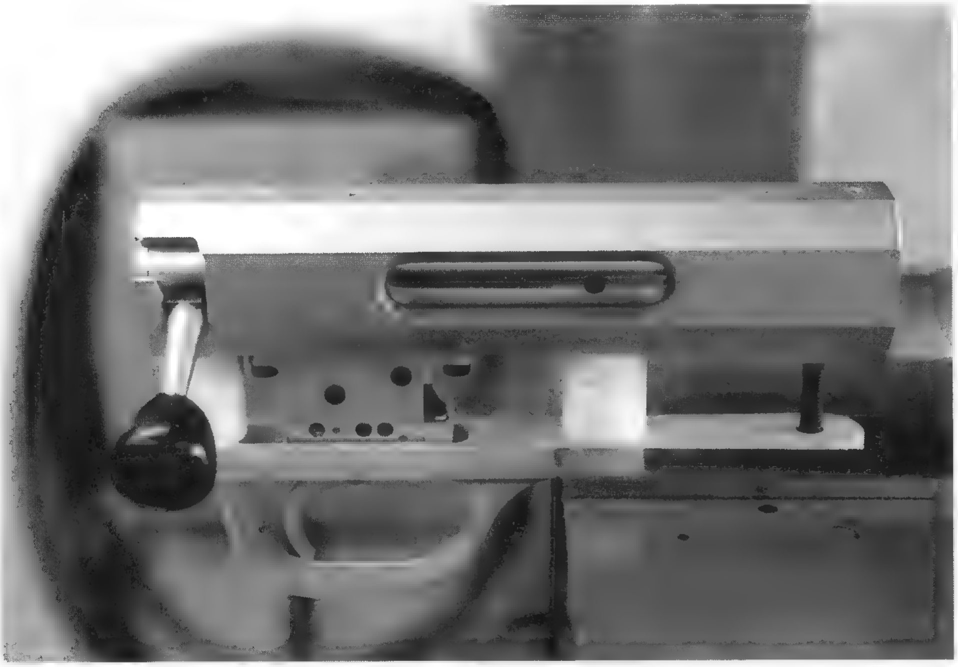
The 150 miles between home and range means I don't get up there as often as I'd like, but I do manage a couple of trips annually. SVSC's newsletter carries notices of frequent matches, and I had read Tom Lintner's report (June '96 Precision Shooting) on Bob Gamboa's Palma rifles and the '96 Sloughhouse-B.C. match. I resolved to attend the '97 match if my schedule permitted, and get in some shooting as well. I sensed a growing interest in Palma shooting (see PS covers, April and June '96). More importantly, I wanted to assess the current thinking on equipment and loading techniques necessary to compete successfully at the highest levels. I would not have any trouble finding competent testimony; among the American competitors this year were former Palma team members Bob Gamboa, Otto Weber, Mike Dunia, Johnie Franklin, Rudy Wadekamper, Tom Whitaker and Noma Zinsmaster. The Canadian contingent included past Palma members Ken Westling ('99 Palma team captain) Bob Pitcairn, John Paton, Clint Dahlstrom, Hans Adlhoch, Peter Page, Gordon Hulbert, Imre Szabo, Leo D'Amour and Patty Dahlstrom.

Some of these fine shooters are also among Palma's leading technical gurus as well. Bob Gamboa is widely regarded as building the definitive Palma rifle these days, and many of his rifles were at work during the match. Canadians Bob Pitcairn and Bill Turner are among Palma's leading load researchers, and were frequently consulted over the weekend. Otto Weber is an importer/supplier well known to PS readers, and is responsible for bringing the pre-eminent RPA action to the New World.

My investigative methodology for this event was simple: get into everyone's face early and often, and ask any inane question which came to mind. The victims of all this were mercifully tolerant, and answered my questions with good humor, speaking slowly and using small words. In the interests of clarity, I'll summarize by category:

Actions: There's been a big change in this regard since the early '90's. The overwhelming choice now is the British-made, American-designed RPA, known in previous incarnations as the Paramount and Swing. Otto Weber had brought some actions with him, and was kind

Lonnie Kumns, left, directs practice at 800 yards.



4 pounds of precision... the heavy, octagonal RPA action.

enough to disassemble one for me to inspect. This is a rather massive 4 lug design, with locking lugs and bolt body of the same diameter, a la Weatherby MKV. It has a 450 bolt lift, a spring-plunger ejector, and a post-'64 Model 70 style extractor. Its most noteworthy technical feature is its striker spring, which is not a coil unit but rather a series of slightly conical spring washers, which are stacked back-to-front over the firing pin. These compress on cocking, and seem to generate a very quick lock time, aided by a very short striker travel of some 3/16". Dry firing these actions produces a very crisp, assertive CLICK, with none of the spring resonance sometimes felt in other actions. Those who should know say that these actions have never yielded a hangfire or misfire, which American shooters have previously experienced when brisk weather, hard primers and weak springs combine.

Bob Gamboa, who knows a thing or three about good Palma rifles, puts this action at the top of his list. Bob was generous with his time and hospitality to your correspondent, providing a tour of his shop facilities and answering many questions. We examined two of these actions, and I was immediately struck by the impression of solidity they conveyed. This was explained when I weighed two examples - the "light" model (1.375" round receiver, Mauser-style front recoil lug) weighed in at 54 ounces, while the new octagonal version came in at 63 ounces. Although I did not have the chance to conduct close measurement of these units, their fit and finish appeared first rate. I'm not personally familiar with the trigger mechanism, but those I tested yielded crisp, creep-free letoffs in the 3 1/2 pound range (the international Palma minimum is 1.5 kilos, or 3.3 pounds). I see much in these actions to admire, and nothing intrinsic which might detract from their use in slow fire competition. Their record of success in Palma competition speaks for itself.

A wide variety of other actions were also in evidence, including RPA predecessors Swing and Paramount, a couple of Stolle Pandas, one of the new AMT's, a Musgrave or two, several Remington 40x's, two Winchester model 70's, a Mauser 98, a Mauser 96, a Howa, plus a scattering of others. Tom Whitaker, one of the top Palma shooters in the USA, was using a Stolle, but most of the other top finishers were equipped with the RPA.

Barrels: The runaway favorite was the stainless Kreiger 30" Palma contour (about like an extra-long #5), 13 inch twist, .298 bore diameter, .3065 groove diameter. British Palma shooters, stuck for years with mediocre military ammunition, found out that a tight bore seemed to mitigate for poor ammo quality, and this has now become a convention. The corresponding Obermeyer barrel is also highly regarded, but seems to be less available. Other makes were also in evidence in ones and twos, including 1 in 14" Schultz & Larsen chrome-moly barrels, and stainless versions by Smith, Border, and Madco.

Sights: Considerable variety here with Warner, Paramount, Swenson, Central, Parker-Hale CH, Rangesport, Gehman, R&P, Tiger (and doubtless some others) being represented. Adjustable front sights are common, in order to aid in proper stock fit while maintaining a long

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It's the little things that count!

Continued on next page

Palma Shooting
Continued

range zero. Diopters and filters are in common usage. Several blooptubes, 10" to 12" in length, were also spotted.

Ammo: The most common ingredient here was the Sierra 155 grain HPBT, the official Palma bullet. However, a few were also shooting Walt Berger's low-drag 155 gr. boattail, which offers a ittle ballistic advantage but demands greater loading attention. There seemed to be more Winchester brass in use than any other. Primers varied considerably, but RWS appears to be gaining in popularity. IMR 4064, 4895, Hodgdon's Varget, Reloder 15 and Vihtavuori N540 were all in use, but the N540 and Varget are on the ascendancy. Canadian loading guru Bill Turner really likes the N540, reporting single digit SD's and many of his teammates have joined him in its use. The Americans show a preference for Varget, but gunbuilder and leading competitor Bob Gamboa is sticking with IMR 4064 for the time being. It is giving him low extreme spreads and high accuracy, and he has a lot of it.

There is considerable disagreement on moly-coating. About a dozen Canadians and a fair number of Yanks were using it,. reportedly for its barrel-life and long range ballistic advantages. Another school, with Bob Gamboa as its principal exponent, holds the view that you aren't going to shoot it at the Big Dance, so compete with something resembling what will be used in South Africa in 1999. The Dean of Canadian Bisley shooters, hospitable Bob Pitcairn, has done extensive experimentation with moly-coating, and likes it. He reports that you need to add 1.5 grains of whatever you're burning in a typical .308 load to get you back to your original velocity.

Long range shooters spend considerable time worrying about standard deviations and extreme spreads. This is due to the exponentially increasing effect that gravity has on ballistic bodies as range increases. To illustrate the foregoing, I constructed a series of computer-generated ballistic tables for a hypothetical, rather warmish Palma load, zeroed at 100 yards, using the Sierra 155 at a top velocity of 2950 feet/second. In one scenario, the extreme spread was held to 20 feet per second (i.e., a minimum velocity of 2930 F/S), and in the other,. a 50 F/S extreme spread was assumed (a rather frequent occurrence with centerfire rifles). The vertical differences at 200 and even 300 yards were minimal; scenario "B" produced increased vertical dispersions of only .08" and .32" more than scenario "A" at these respective ranges. The picture is altogether different at 1000 yards:

A marriage of form and function — 3 of Portsider Bob Gamboa's Personal Palma Rifles.

Velocity-Induced Vertical Spreads:

Scenario "A":
6.33" (338.03 to 331.70 inches low)

Scenario "B":
14.06" (345.76 to 331.70 inches low)

A 14" difference will take an X to a 9 and a 10 to an 8. One such excursion during a match is more than enough to cost a shooter a victory...thus the preoccupation with uniform velocities!

Stocks: Everybody shoots an adjustable prone-style competition stock. A good many McMillan prone stocks were in evidence, despite being a bit shy in depth for the RPA actions. Some laminated wood stocks also made appearances, set up in the same manner as the others. Bob Gamboa has a particular love for natural walnut stocks, and a good many of his rifles were outfitted accordingly. I inspected something like 30 lovely California walnut blanks in his garage, each generously endowed with fiddleback, crotch figure, and/or color striations. They look like a million bucks, and the fact that they shoot so well is a tribute to Bob's stockmaking expertise.

This year's match was scheduled for the 7th, 8th and 9th of March, with a day of practice offered on Thursday the 6th. An excellent field of 53 was enlisted, including a contingent of 16 Canadians and two women shooters. Practice day came off as planned, with much tinkering and adjusting whilst firing at 800, 900 and 1000 yards. I was able to get in some 1000 yard work with my scoped .284, since this was not yet for-real. The weather was shaping up to be a real treat this year, and so it was to be, with mid-day temperatures in the 70's and sunshine galore! The snow-capped crest of the Sierras was plainly visible on Saturday, some 70 miles to the northeast. A great weekend for a shoot...except of course for the wind. Here, variety was the name of the game, with dead-calm conditions early on, building to a good westerly breeze, 6 to 8 knots, by late morning, and finally into gusty, fishtailing afternoon winds of 10 to 12 knots, varying northwest through northeast. The wind flags would frequently point in several different directions at once, a tribute to the bare hills, hummocks and low ridges which characterize this patch.

Five shooters got off to a fast start on Friday, posting scores of 353 and up for 12 shots each at 800, 900 and 1000. Tom Whitaker dropped but a single point, this at 1000 yards, to lead the pack. Bob Gamboa was 3 shots back with 356-14x, and Noma Zinsmaster did herself proud with a 354-15x to occupy third. Mike Dunia and Ken Westling were both at 353, Mike having 11x's and Ken 8.

The wind conditions degenerated further on Saturday, and aggregate scores (for a duplicate course of fire) showed it. Bob Gamboa topped the board with a 349-20x, four better than Tom Whitaker at 345-16. Gamboa and Whitaker now stood 1-2, with Gamboa ahead by a single point. Johnie Franklin and Leo D'Amour both improved on their Friday performances with 348's. J. Donner fired a 349-10x, Saturday's second best score. Noma Zinsmaster continued her consistent performance with a 343-13x, to finish third for the two days.

Sunday's course of fire was a 10 shot shoot-off at 1000 yards among the top 10 individual shooters, this to be added to the prior score for the individual championship. Tom Whitaker trailed Bob Gamboa by a single point going into this round., Both fired an identical 99-4x, so Bob Gamboa emerged as the individual champion by a single point! Johnie Franklin and Noma Zinsmaster led Sunday's match with a 100-5x each, and Ken Westling proved the cobwebs were gone with a 99-5x. Thus, Noma finished third overall, with Ken in fourth.

The Individuals were followed by a 20 shot Canadian/American 12 person team match, with the Yanks eking out a 15 point, 2x victory. This margin of victory is equivalent to less than 2/3 of 1%! It is noteworthy that both women competitors, Noma Zinsmaster and Patty Dahlstrom, made this match and shot well. The team shooters and their respective scores were as follows:

In closing, I extend special thanks to Lonnie Kuhns, his family and friends, for being such great hosts over the 4 days of the event. SVSC also deserves high praise for promoting this and other long range matches and attracting shooters from all over North America. The spirit of camaraderie was palpable throughout this match, highlighted by a terrific barbecue on Saturday night. I look forward to the '98 event, and hope it will equal and exceed this year's in both shooting virtuosity and old-fashioned fun.

Meanwhile, Palma-type competition continue to evolve. I find myself hoping for international recognition of a co-equal optical class. I'm also curious if there's any language in the rule book that explicitly prohibits moly-coated bullets. Perhaps someone should have a word with the South African host committee...

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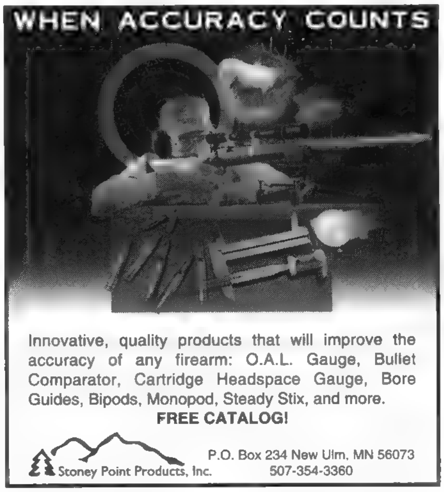

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MISADVENTURES IN BALLISTICS

AND WHY BC IS BS AMONG OTHER THINGS

BY RANDOLPH CONSTANTINE

"Space Shuttle Fuel Tank Hits Madagascar Capitol!" That is a newspaper headline that never was, and I would like to think I had something to do with preventing it from happening. Another headline that never saw print was: "Space Station to be built of Shuttle Fuel Tanks". This second one is something that I think should have happened but did not. In both cases the results from an exterior ballistics computer program I wrote may have been involved in the decision making process.

Back in the time period from 1974 through 1986, I worked as a mathematician/engineer/computer software designer for a company doing contract work at NASA's Johnson Space Center down near Houston, Texas. My company won a contract to write a large number of programs that would be parts of a complex system called the Flight Design System or FDS. FDS was a system which would be used to plan missions for the Space Shuttle.

I went to work on the FDS project; and after a while, I was put in charge of a task to write three programs for the FDS system, two of which were ballistic in nature. One of the two ballistic programs was one that would predict where the spent external fuel tank from the Space Shuttle would come down. It was called ETIP for External Tank Impact Predictor. The other ballistics program computed where the spent solid rocket boosters (SRBs) would come down and was called SRBIP. Something you may find significant is that the concepts of ballistic coefficient and sectional density were never used anywhere in either of these highly technical, real-world ballistics programs. More on this later.

My team consisted of myself and two other guys. Each of us had a single program to develop, but whenever a big problem arose we would all pitch in to get it solved. I assigned myself the task of developing ETIP, and the other two got SRBIP and the visibility program called Sunrise-Sunset.

NASA needed to know where the External Tank (ET) was going to come down primarily for safety reasons. It would not be good PR to have it come down on a populated area or on a ship.

Remember the April Fool story about the Japanese fishing boat that was supposedly sunk by a cow that some Russians ejected from a cargo plane because the cow supposedly went berserk and was threatening to destroy the plane? Well, the ET weighs almost 200,000 pounds — a lot more than a cow — and it comes down a lot faster than a berserk bovine. Actually, the ET weighed about 192,000 pounds in the early days of the program before they stopped painting it. Leaving off the paint reduced its weight by a few thousand pounds, but did nothing to change the speed with which it entered the atmosphere. All the launches were planned with the idea that the ET should land in the southern Indian ocean far from any normal shipping lanes or populated areas.

The need to know where the SRBs were going to come down was a bit more mundane and economic. The casings of the SRBs were designed to be reused, and they come down in the ocean a few miles off the coast of Florida. They do not come down in the same place for every launch because where they (and the ET) come down depends on what orbit the Shuttle is being launched into.

NASA needed to know where the SRBs were going to come down so they would know where to send the salvage boat out to pick them up so they could be refurbished. The SRBs are equipped with parachutes and are designed to float once the fuel is all burned up, but who knows what can happen in the real world. Remember, Murphy never sleeps. The idea was to know where to send the boat so that the boat could pick them up quickly before anything weird happened and one or both of them sank.

Now, developing software is not always a straight-forward task. It involves long hours and late nights. A missed keystroke, a simple typo made by a sleepy programmer or a misreading of a complex formula can cause a program to produce weird results and can be the devil to find later on. SRBIP was a smaller program than ETIP so it was ready for testing much sooner than ETIP. We learned something that the environmentalists need to know — that the world does not always work the way a computer program says it does.

The first time we ran a full test of SRBIP, the program did not stop as it should have; we had to stop it manually. When we looked at the trajectory data from the program we could see that the SRBs were merrily heading for the moon and beyond and picking up speed as they went. There was this little matter of a wrong sign. It turned out we had gravity pushing instead of pulling. Changing one sign in the right place from a plus to a minus fixed the problem. But boy, that anti-gravity was neat while it lasted!

After we had gravity working in the

right direction, in the next test everything was going along fine until the parachutes deployed. The SRBs headed out into deep space again. This one was a little more subtle.

In almost every external ballistics program, what you do is compute the trajectory of the projectile in steps. It does not matter whether the projectile is a bullet, a thrown rock, an airplane or a re-entry vehicle, the trajectory is computed in little steps. To compute the position and velocity of the object at some time, you have to know its position and velocity at some earlier time. At that earlier time, you compute all the forces operating on the object — gravity, drag, lift, propulsive forces, etc. — and then you "integrate" those forces to come up with the position and velocity of the object at some future time. To compute where something like a bullet will be 1.0 seconds after it is fired, you may have to compute 1000 or more steps to get any kind of decent accuracy.

In ballistics programs, these steps are usually time steps, i.e. increments of time. You know where the thing is at a certain time and you compute where it will be a certain amount of time later, say, one-thousandth of a second. Now, one-thousandth of a second may not seem long, but if you are talking about a bullet that is moving at 3000 ft/sec, that bullet will move about 3 feet in that amount of time. The ET moving at about 25,000 ft/sec moves about 25 feet in that short amount of time. Of course, I can't say here exactly how far the things will really move during one of the time steps because the forces of gravity and air resistance work to change those speeds even during those short time steps, and you have to know the exact conditions of position, velocity, altitude, air density, etc. to be able to compute exactly what the forces on the projectile are. That is part of what makes the writing of ballistics programs a challenge.

Most simple ballistic programs use a time step of a fixed size that is usually small enough to give you accurate results in almost any situation the program is expected to cover. If you have a situation in which you could have used a much larger step size, you just have to put up with the program's taking a little longer to give you the answer than it would have if the step size had been optimum. It does not happen often, but occasionally, you need to have a really small step size when something of a wild and transient nature is happening. That was what bit us on the second test of SRBIP.

When the SRBs' parachutes opened, the drag forces very suddenly get very large (and I do mean LARGE), but they stay large only for a very short time. With the constant and relatively large step size we were using in the program, our model had that really large drag force pulling on the SRB for a period of time that was much too long for what was happening in the real world. That much force acting on an SRB for such a long time would have accelerated the SRB up to a speed high enough to send it into orbit, and that was what the program told us was happening. Again, the fix was simple: Make the step size variable and dependent on the magnitude of the acceleration the SRB was subject to; when the acceleration was high, make the step size small. That fixed what we had come to call *the parachute-to-orbit problem*. From then on, things went smoothly with SRBIP.

I had my own problems designing ETIP, but none quite as dramatic or as funny as anti-gravity or parachute-to-orbit. The interesting fall-out from ETIP came after the program had been completed, passed its preliminary testing, and been delivered to NASA for use.

While I was working on ETIP, there was another group working on some graphics programs that would plot the output from ETIP and SRBIP. One program called ETPLOT took the output from ETIP and drew a map (Mercator projection) of the Earth on which the ground track of the External Tank was plotted from the point of separation of the ET from the Orbiter to the point of impact of the ET on the surface. ETIP also computed the size and shape of the footprint of the most probable impact area of the debris from the ET. ETPLOT also drew this debris footprint around the impact point on the map. What's a ground track, you ask? For a missile or a satellite, imagine a line from the center of the Earth up to the object. The ground track of the object is the curve that is traced out on the surface of the Earth by the intersection of this (imaginary) line with the surface of the Earth as the object moves along its orbit or trajectory.

The ET is designed to break up into 21 pieces when it re-enters the atmosphere. Even so, being hit by only one of these pieces at about 10,000 pounds (that's a 70 million grain projectile, chum) coming in at about Mach 20 just might ruin your day. Of course, the terminal velocity at impact would not be quite as high as Mach 20, but with that much mass who would notice? A mass equivalent to five Volkswagen beetles moving at any speed more than 1 foot per second is going to make a pretty deep impression on anything it lands on; at Mach 1 or better, it would be truly formidable.

One day a DR (discrepancy report) came in on ETIP from an Air Force mission designer who reported that ETIP just ran on for about 45 minutes without stopping before he killed it. The usual run was under two minutes.

It turned out that he had asked the program to use an atmosphere model called the Jacchia model. (Jacchia is pronounced *Yah-key-ah*, if you care.) The Jacchia model was a specialized model designed for doing orbital decay tests at very high altitudes, 400,000 feet and above, and it contained no information for altitudes lower than 400,000 feet. In fact, the Jacchia atmosphere model gave a default value of zero for the value of the atmospheric density at any altitude below 400,000 feet! At low altitudes, ETIP thus computed the drag on the tank to be zero!

We reran the program in a diagnostic mode using the Jacchia model and dumped the results. What we saw told us that the tank would actually be in orbit if the Earth had no atmosphere. Oh, the tank went up as high as 110 miles and came down as low as 22 miles, but since its *no-air* "orbit" never impacted the surface, the program never stopped. Our response to the DR was short and to the point: "Don't use the Jacchia atmosphere model with ETIP."

Now, what about Madagascar? In the early days of the Shuttle program, there was a lot of talk about how the Air

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Misadventures in Ballistics

Continued

Force was going to get its own Shuttle to use for military missions to do things like launch spy satellites and such. Many of these missions were planned to be launched from Vandenberg Air Force Base in California.

There were two reasons to want to launch from Vandenberg: 1) Security — much better security could be had on a military base than at Cape Canaveral, and 2) Range safety. Well really, it was to be able to get into highly inclined or polar orbits. One of the ideas was to be able to launch into a polar orbit or into orbits that were highly inclined relative to the plane of the equator, something which could not be done from Cape Canaveral without endangering the northern United States and Canada if you launched to the north.

And we can't launch to the south from the Cape because that endangers populated parts of south Florida, not to mention Cuba, and Central and South America. If we launched due south from Cape Canaveral, the SRBs would land in the Everglades, or maybe on Miami. Nobody knew for sure where they would come down because any idiot, much less a bunch of rocket scientists, could see that launching to the south out of the Cape would not be a smart thing to do. So, we never even ran a test of SRBIP for a launch to the south out of the Cape. In retrospect it would have been an interesting thing to do. However, preliminary studies had led everybody to believe that there would be no problems if we launched due south out of Vandenberg.

Why the desire to be able to launch into a highly inclined orbit? Simple, the Space Shuttle is limited to orbits that do not go much higher than 300 nautical miles above the surface of the Earth. You can get higher with no payload, but why bother? Also, if your orbit has to stay down near the equator and you cannot get very far above the surface, then you will not be able to see very far to the north — to such interesting places as Murmansk, Vladivostok and Novaya Zemla, or even London, Rome or Istanbul — whereas a low-Earth, polar orbit will put you almost directly over every point on the surface of the Earth at least once in less than 24 hours. Thus, the desire for polar orbits.

Once we had gotten both ETIP and ETPLOT up and running and debugged we had a lot of fun playing what-if as part of our testing. Now, ETIP and ETPLOT had to be able to handle launches from anywhere, even your Aunt Minnie's garden or Times Square, so one day we ran a test with data for a nominal launch out of Vandenberg on a due south heading for a polar orbit just to see what the plot would show. Ka-wham!! Guess where the plot showed that the ET would come down? ... Right smack in the center of downtown Majunga, a large city on the northwest coast of Madagascar.

Oops! Looks like somebody missed something in those preliminary studies. What was worse was that the debris footprint extended over the entire length of the island, covering the capital, Antananarivo, and also extended north over the Seychelles. The entire island would have been shotgunned with 21 pieces of US government property crashing out of the sky. Just how many international incidents such a launch would have caused can only be guessed at.

We sent word of this up the chain of command, and we never heard anything back from higher up. All that I know is that the Air Force never bought its own shuttle and there has never been a Shuttle launch out of Vandenberg in any direction. To this day, I have to think that our test of ETIP had something to do with those decisions. Makes you wonder.

That run of ETIP made by the Air Force mission planner with the wrong atmosphere model gave me an idea. It told us that the ET was essentially in orbit when it separated from the Orbiter. It was just that the ET's altitude at perigee (the point of closest approach to the surface) was much too low to remain in orbit. It did not take a lot of calculation to see that it would not require very much extra fuel to take the tank on up into a circular orbit where it could be used in building the space station.

It turns out that a study was done on the feasibility of this idea in 1990. Some objections were raised about the necessity to clean out the tank — blah, blah, blah. As you probably know, the tank has two chambers. One holds liquid hydrogen (LH2), and the other, liquid oxygen (LOX). There is a term in the rocket world — *LOX-clean*. When something is LOX-clean, it is clean enough to be used in direct contact with liquid oxygen. Something that is LOX-clean cannot carry any residues of oils or other organic compounds; it has to be really clean!

Well, what about the LH2 chamber? It might not have been LOX-clean, but it is certainly not allowed to be dirty in there. If one were concerned that residual hydrogen in the tank might pose a hazard of some kind, all that would be required to clean out the LH2 part of the tank would be to open a hatch or port to the vacuum of space for a few days before beginning any construction inside the tank. I think the real reason the objections were raised to using the ETs as part of the Space Station was that the companies who wanted to build the hardware for the Space Station, which was then in the planning stage, saw that using the empty ETs would cut into their bottom lines. Economy and the national interest be damned.

One of the points I want to make about these programs is that the main operating code in ETIP and SRBIP is not all that much different from what is in any other exterior ballistics program. The interfaces to the outside world were special and the file output for ETPLOT was special, but the parts of the program that computed the trajectories of the ET and the SRBs was much the same as what you would find in most ballistics programs except that it had a few more bells and whistles. The major differences lay in the use of models to compute the values of certain quantities for which an ordinary program might simply use a constant.

The two most important of these quantities were the density of the atmosphere and the force due to gravity. I needed atmosphere models that would give me accurate values of the density of the air all the way up to 200 miles above the surface. The gravity model used an ellipsoidal model of the Earth rather than a spherical one since the Earth is more closely ellipsoidal than it is spherical. For an ellipsoidal planet, gravity does not pull objects exactly toward the center of the planet in the mid latitudes, and that can make a big difference in the shape of an orbit or a sub-orbital trajectory.

Another difference was that to find out where the tank would land I had to compute how the tank was being slowed down by atmospheric drag while the Earth and the atmosphere rotated under it. This required continually moving back and forth between an inertial coordinate system and a rotating coordinate system defined by the Earth. This had to be done because the trajectory of the ET from the time of its separation from the Orbiter to impact goes about halfway around the Earth, and the time of flight is on the order of 45 to 50 minutes, during which time the Earth rotates a significant amount. An added benefit to this approach is that Coriolis effects are automatically accounted for by this coordinate switching, so it unnecessary to compute Coriolis effects separately.

Most canned ballistic programs assume a flat, immovable Earth with constant gravity because the both distances involved and the times of flight are small in comparison to the radius of the Earth. For computing the trajectories of rifle bullets, a flat Earth approximation is good enough; but for some artillery problems, you do need to go to a spherical Earth model and to account for Coriolis effects.

I would like to be able to call ETIP the "mother of all ballistic programs", but I cannot do that in good conscience because there was one feature it lacked. ETIP only simulated the ballistic behavior of the ET with three degrees of freedom (3-DOF), meaning that it only simulated the gross movements of the ET through the air in three dimensions and did not account for any spinning or tumbling that the tank might do.

Any deviations the tank might have made from the (3-DOF) calculated impact point because of tumbling and spinning were taken into account by the statistics that were used to compute the size and shape of the debris footprint. For that reason, we did not need to do a 6-DOF simulation.

However, I think that the use within ETIP of a rotating ellipsoidal model of the Earth, the use of an ellipsoidal gravity model to match that Earth model, and its ability to use a selection of atmosphere models do at least make it the mother of all 3-DOF ballistic programs.

Even with all these nifty features, there were, however, two things missing from ETIP that seem to be dear to the hearts of shooters of rifles and pistols: the ballistic coefficient of the tank and its sectional density. These items were never used or needed, yet as far as I know, the program worked perfectly and is still in use.

Guess what? Nobody, and I do mean nobody, who builds programs to compute the effects of atmospheric drag on a moving projectile ever talks about "ballistic coefficients" unless he is writing the program for sale to shooters. As far as I know, shooters are pretty much the only people in the world who still talk about ballistic coefficients. Perhaps some artillery people still do, But when anybody who still talks in terms of BC wants to compute range tables, he has to convert his ballistic coefficients to drag coefficients for use in the computer program. The reason why is simple; everybody else talks in terms of drag coefficients and uses the drag equation. The drag equation is a simple equation that tells us how to compute the drag force on a body moving through a gas.

A trumpet fanfare please, maestro. Here, ladies and gentlemen is the drag equation:

$$F_d = \tfrac{1}{2}\, \rho_d A_f\, v^2$$

This formula is the basis for all our calculations that have to do with drag. Let me define what all these symbols mean.

F_d is the magnitude of the force due to drag;

C_d is the drag coefficient of the object;

A_f is the frontal area of the object, i.e. the area of the object when viewed from the direction of travel. A bullet has more frontal area when it is traveling sideways than when it is point on.

ρ (the Greek letter rho) is the density of the gas.

v^2 is the square of the magnitude of the speed of the object relative to the gas.

The factor of ½ comes from some calculations which relate this formula to some others. This factor (of ½) could be absorbed into C_d, but that is not usually done because the drag coefficients for standard objects like spheres, cylinders, cones, etc. have standard values given in tables, and everyone who works with this knows the ½ is part of the formula.

Look at what is not here. There is no mention of ballistic coefficient or sectional density, not even any mention of the weight of the object. But what about this drag coefficient, C_d? Isn't that the ballistic coefficient? No, it's not. In fact, C_d is the thing some people call the coefficient of form.

The drag equation has a long history. Some of its features were discovered as long ago as the early sixteenth century by an Italian mathematician named Niccolo Tartaglia who worked on early artillery problems. Sir Isaac Newton established to his satisfaction that the drag force on a moving body was proportional to the square of its speed. Over the years, other scientists have refined and simplified the drag equation until it now appears in every fluid mechanics and aerodynamics book in exactly, or almost exactly, the form in which I have written it above. And yes, until the Wright brothers came along, almost all the research into drag effects concerned projectiles and was motivated by a desire to be able to employ artillery more accurately.

This last is a very important point and needs to emphasized: The development of artillery in the 1800s drove the development of the science of exterior ballistics. That is how the Gâvre commission, Mayevskii, and Ingalls got into the picture. I'll get to them in a bit, but first let's look at the development of artillery in the 19th century.

At the end of the18th century, the development of artillery was stagnant. Cannon were cast and bored as they had been for many years. The propellant was still black powder and the projectiles were round balls. To say that

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Misadventures in Ballistics
Continued

artillery was stagnant at the time is not meant to imply that there was no research going on. The desire to improve artillery also drove much of the technological development of the 19th century, as well as driving the development of ballistics.

The year 1800 brought some new developments that were important not only for artillery, but for all of technology. In fact, the history of the development of artillery during the 19th century is almost a history of technology itself. Great progress occurred in the development of machine tools, better steels, better propellants, and better artillery projectiles.

There was a problem with different projectiles: To get more weight they had to go to a cylindrical design. The cylindrical projectiles, usually with conical points, called cylindro-conoidal, could be made much heavier than spheres of the same diameter, but would not fly straight out of a smoothbore and thus often did not have the range or the accuracy of a round ball because they tumbled. Such projectiles needed to be spin-stabilized, which meant producing cannon with rifled bores.

According to my 1942 *Encyclopedia Britannica*, rifled cannon were first produced in 1846, independently by Major Cavalli of Sardinia and Baron Wahrendorff of Sweden. Once rifled cannon with cylindro-conoidal projectiles came into common use, the old range tables were useless, and new ballistics studies were needed. The science of ballistics was still in its infancy, but adolescence was not far off.

The use of the cylindro-conoidal projectiles in rifled tubes gave the cannoneers much greater range than they had had with the round balls, even though the propellant was still black powder. Captain T. J. Rodman in the US developed a method of producing black powder moulded into large granules which were hexagonal and perforated. Rodman's "Mammoth" powder burned much more uniformly and gave higher velocities with lower peak pressures than standard cannon powder, but to get even higher velocities with the heavier new projectiles, the cannon needed to be stronger. With the steels available at the time, this required new methods of fabrication such as shrink fitting hoops around the breech of the gun. The new methods of making cannon with built-up breeches were developed in the 1850s and 1860s, and soon, higher velocities and significantly longer ranges were a reality. To get even higher velocities and longer ranges would require smokeless powder. Much experimentation was done in that area before a safe and satisfactory powder was developed by Vieille in France in 1884.

Much of the early ballistic work with the new projectiles and guns was purely empirical — take a certain projectile of a certain weight, put a certain powder charge behind it, and fire it at a certain angle of elevation. Then go out and measure how far it went. This sort of thing was done by most of the early artillerists; but later on, systematic analyses were done with an eye to developing a predictive theory of ballistics.

In France, the Gâvre Commission began its studies in 1873 and continued through 1898. In 1881, Krupp in Germany did a lot of range testing using ballistic pendulums and early, primitive chronographs. The data taken by Krupp were analyzed by a Russian colonel named Mayevskii who came up with models that were very useful in their day.

Some of the history of these investigations is given, with technical details, in Chapter XXIII of *Hatcher's Notebook* on pages 549 to 567 and in the *Sierra Rifle Reloading Manual, 4th Edition*. Based on what I read in *Hatcher's Notebook*, I have come to the conclusion that it was Mayevskii who started some of the things I think of as mistakes; others merely perpetuated them. Also, according to Gen. Hatcher, Col. Ingalls of the USA converted Mayevskii's results (from metric) to English units and based what became known as the Ingalls tables on that conversion.

The things I view as problems or mistakes exist not because Mayevskii, Ingalls, the members of the Gâvre commission in France, and the other early investigators were dummies. Far from it; they were the founders of the modern science of exterior ballistics. However, the founders of any science usually make some false starts or come up with some theories and computational methods that are later superseded. We do not call Galileo and Newton dummies because their physics was superseded by that of Einstein.

Consider two other men who were not dummies: John Napier and Henry Briggs. These two developed the method of using logarithms as a computational aid for doing multiplication. Logarithms have been used extensively since that time by anybody who had to do a lot of arithmetic that involved multiplication with numbers of more than two significant digits, that is until calculators that could do multiplication came on the scene.

Many major developments in exterior ballistics occurred in the period from about 1860 to 1910, a time when anybody who had to do a lot of calculations thought in terms of tables such as the logarithm tables they used so often. The ballisticians of that day not only thought in terms of tables, they also tried to bend the mathematics and some of their concepts to fit the tables they came up with. Some of the things they did turned out to be flat wrong and yet have been carried forward and appear in current writings as gospel. In my opinion, one of these mistakes is the concept of ballistic coefficient, which seems to have been conceived by Mayevskii.

What Mayevskii did was make a fundamental error in the application of the scientific method — he did not look for the simplest model to explain his data. He decided that he thought he knew what the drag equation should look like (it had not yet been fully formulated in his day), and then he forced one variable in the equation to take on different values for different velocities when it should have been a constant while assuming that another factor was a constant when in fact it was not.

Mayevskii and the other ballisticians of his day preferred to look at what they called the "retardation" of the projectile. This was nothing more than another term for the acceleration the projectile was subject to because of drag. To get the acceleration from the standard drag equation, all one has to do is recognize that Newton's second law of motion tells us that force equals mass times acceleration, or F = ma. We get the acceleration by dividing the force by the mass. If we do this with the drag equation, we get:

$$a_d = \frac{\tfrac{1}{2}\rho C_d A_f v^2}{m}$$

where a_d is the acceleration due to drag, and m is the mass of the projectile.

Mayevskii's formula is algebraically similar to this. He wrote:

$$R = Av^m$$

where R is the retardation of the projectile (just another word for the acceleration or deceleration, if you prefer) and A is a constant which is really equal to the product of all the factors in the drag acceleration equation except for the square of the speed.

What is different and what he thought was significant was that with this formulation he was able to get very good agreement with the experimental data Krupp had obtained *if he used different values of the exponent* m *for different ranges of velocities.* Interestingly enough, he did use m = 2 for velocities from 0 to 790 ft/sec, but then went to m = 3, then 5, then back to 3, then 2 and then down to fractional exponents with m = 1.7 and finally m = 1.55 for his top range of velocities from 2600 to 3600 ft/sec. This sort of thing is entirely *ad hoc*, but was much better than anything anybody else had done before then. Also, he would have had to use logarithms to do his calculations with the fractional exponents.

The use of the ballistic coefficient came about because back then everybody thought that all projectiles had to act pretty similarly. They thought that if they had a lot of good data tabulated about a standard projectile then all other projectiles could be compared with this standard by measuring the "retardation" of both the standard projectile and test projectile **at the same velocity**. The ballistic coefficient of the test projectile is then simply the quotient R_{std}/R_{test} where R_{test} is the retardation of the test projectile and R_{std} is the retardation of the standard projectile.

The big mistake was to assume that the ballistic coefficient was a constant, independent of the speed of the projectile. The idea was that once the ballistic coefficient of a new projectile was determined at one speed, the ballistician could then calculate a table of retardations for the new projectile from the known retardations of the standard projectile using nothing more than simple multiplication, since $R_{std} = BC_{new} x R_{new}$. To some extent, the idea was a success, but not entirely.

What's wrong with all this? Well, in modern computer parlance, Mayevskii's model with the variable and weird values of m in the v^m factor is a nothing more than a *kludge*. It would be a few more years before the science of fluid mechanics matured to the point that "everyone knew" that the drag equation as I have written it above was the correct and only way to go in all situations. What does this mean for Mayevskii's situation? Well, the answer is sitting right there in the drag equation.

If you always have v^2 and not v^m for some oddball value of m, something else has to change and it can only be one thing, namely, C_d, the drag coefficient. The density of the air and the frontal area of the projectile are indeed constants as is the number ½. All that is left that can change is C_d, and that is the way it is now in the fluid mechanics world. **The value of the drag coefficient is a function of the speed of the projectile; it is not a constant.**

What does this mean for the concept of ballistic coefficient? Unfortunately, a lot. A little algebra with the drag acceleration equation and the equation that defines the BC will show that the BC of a test projectile bears an inverse relationship with its drag coefficient. This means that no matter how hard Mayevskii wanted the BC to be a constant, it is not; and the way it varies differs from one projectile to another depends on both the shape of projectile and the speed at which it is going. In short, the ballistic coefficient is not a constant any more than the drag coefficient is.

And what does this imply about using the BC to compare one bullet to another, something that almost all shooters do in the absence of any other basis of comparison? Simply that it sometimes that may lead to comparing grapes to apples to oranges.

I don't know of anybody who might want to compare something like Sierra's 80 grain, .22 caliber match bullet to a 170 grain flat-nosed .30 caliber bullet designed for use in the 30-30, with a 500 grain round-nosed lead bullet for the 45-70, but according to Mayevskii and all the other folks who are in love with the concept of ballistic coefficient, you should be able to do it and get valid results. There is a very large problem lurking here that most books do not bother to tell you about — because the BC is not a constant, ballistic coefficient comparisons make sense only if the ballistic coefficient of each bullet was measured at the same velocity! Trying to use the BC to compare the three bullets mentioned above when those BCs were probably measured at 2800 ft/sec, 2200 ft/sec and 1200 ft/sec is a totally meaningless exercise. Making that comparison may momentarily amuse the person who does it, but it will give him less useful information than a recipe for a rhubarb and tofu pizza.

If you get the idea that I do not like the concept of ballistic coefficient, you'd be right. It does not work the way its originators intended because they thought it had to be a constant for all velocities, which it is not. By using BC (as a constant) instead of C_d (as a function of velocity), one is using a flawed concept to compare a modern bullet to a 19th century artillery projectile instead of knowing something about the actual drag behavior of the bullet on its own, independent of how any other projectile performs.

The most comprehensive and readily available, contemporary exposition on exterior ballistics is in Chapter VIII in the *Sierra Rifle Reloading Manual, 4th Edition*, but even there the discussion is based on the use of BC. This book gives a more detailed history of ballistics than I have given here and follows the subject up to modern times. Unfortunately, it shows that military and other small arms ballisticians are still stuck on ballistic coefficients. However, there is at least a discussion that the BC of a bullet takes on different values at different velocities on pages

Continued on next page

Misadventures in Ballistics

Continued

596 and 597 therein. The authors express concern about this, but fall back on BC as the solution. There is a better way.

The BC of a bullet and its drag coefficient are in a reciprocal relationship to one another. When one is large, the other is small and vice versa. The obvious thing to do is to measure the C_d function of one bullet very carefully in increments of 100 ft/sec for all velocities from 0 to their usual maximum, and then measure the value of the C_d of any other bullet of similar shape at one standard velocity, say, 2000 ft/sec. Using this value, one could scale the C_d function of the first bullet to get a C_d function (actually a table) for the second bullet similar to what is currently done with BC. This would enable the computation of very accurate range and wind deflection tables for the second bullet without the necessity of resorting to the inaccuracies inherent in the use of the Gâvre G_n models and the ballistic coefficient.

In §4.6 of that chapter, Sierra discusses the effect of precession (which they call *coning motion*) on the BC of a bullet. From the point of view of the drag equation, it is not the BC which is being affected; it is simply that the drag force increases when the bullet is precessing. The drag coefficient does not change all that much for small angles of bullet yaw, but what does change is the frontal area. For a long bullet, the frontal area increases dramatically for relatively small angles of yaw. The increase in area is noted in the text, but is not given as much importance as I think it should be. The C_d will also increase a small amount, but not as much as will the frontal area. When you think in terms of the drag equation, you think of frontal area, and not of d^2, where d is the diameter of the bullet, which is what is given in the formula given on page 653 of the Sierra manual.

I wanted to discuss sectional density and the lag theory as well, but I have already overrun the amount of room I was allotted, so those topics will have to wait for another day. In fact, I have not said all I would like to say about BC being BS.

I shall close by saying something positive about the idea of BC. We do need some sort of ballistic figure of merit (BFM) for bullets, and it probably should be something like BC. Heavier bullets do lose velocity slower than do lighter bullets of the same shape. Long, skinny, pointed bullets lose velocity slower than short, fat, blunt-nosed bullets of the same weight. It would be nice to have one measure of a bullet's merit that would indicate all this, and BC seems to do this. To avoid the problems caused by the BC's velocity variance, a good candidate for a BFM might be a standardized BC measured at a standard velocity, say, 2500 fps, or some other velocity, but pick only one and use it for all bullets. Or, pick one standard velocity for rifle bullets and another for pistol bullets. I would prefer that the BFM be defined to be the bullet weight divided by the product of C_d and the frontal area; i.e. BFM = w/C_dA_f. This would allow the direct use of the BFM in drag calculations without any necessity for messing with fudge factors to get things right as is necessary when all you are given is a value for BC.

For all the reasons I have given, I think BC is BS, but even BS is useful, at least as fertilizer. The concept of ballistic coefficient fertilized the field of exterior ballistics for over a century, but there are better tools and ideas available now. With a desk top computer, one no longer need fiddle with the Ingalls tables. With a simple program and proper description of the C_d of a bullet, one can compute a trajectory table out to 1000 yards in a few seconds. I think it is time that the science of ballistics should set aside its 19th century ways and scrap the idea of ballistic coefficient, or at least recognize it for the flawed concept it really is. Let's start doing ballistics with drag coefficients. After all, it's not only correct, it is easier and more accurate.

Till next time,

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Randolph Constantine

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the holy grail

BY JACK BROGDON

1974 was quite a year, one way or another.

It was the year that I was successful in my application to join a National Rifle Association team, which was to visit Guernsey and Jersey, (the Channel Islands,) and compete against their teams. It was one of the few occasions that an NRA team emerged victorious in both Islands, thanks to the brilliant captaincy of John F. Jackman, who had as his Adjutant, his brother Graham.

My dusty records show that such notables as Arthur E.Clarke, (who more recently became the only man to shoot a 75 ex 75 at 1200 yards at Bisley and Palma Team coach,) John Proctor,(the manufacturer of Paramount rifles,) Jeremy Thompson, (later to win the "Queen's Prize",) and Michael Heathcote, who had a remarkable gift for charming nubile ladies, (apart from being a brilliant shot to boot,) all helped to make up a motley, yet homogenous , single-minded team. My own performance relied on my trusty Konsberg, which was a Swedish Army weapon, in reality, to which I had fitted a swaged Enfield barrel. It proved to be a formidable combination, which provided me with scores which were the open sesame to team aspirations.

Bits of paper, going brown at the tattered edges, show the team results in both islands;

NRA v Guernsey

	300	500	600	total
J. Proctor	48	47	48	143
J.Brogden	48	47	48	143
M.Puttock	49	46	47	142
M.Heathcote	47	44	50	141
J.Thompson	48	48	45	141
A.E.Clarke	47	45	48	140
D,Genders	46	47	47	140
G.Jackman	50	46	44	140
Guernsey	1125			1130

NRA v Jersey

	300	500	600	total
J.Proctor	50	47	50	147
A.E.Clarke	48	48	50	146
J.Brogden	48	49	48	145
J.Jackman	48	48	48	144
M.Heathcote	49	47	47	143
J.Thompson	48	47	47	142
M. Black	48	47	44	139
P.Edwards	49	44	44	137
Jersey	1141			1143

I acquitted myself well, as the team results show, and I continued in similar fashion during Club shoots and the run-up to the Bisley Imperial Meeting, two months later.

On the last Sunday prior to the start of the Imperial, I packed all my gear into a small panel truck I was driving in those days. My shooting box, containing spotting telescope, wash leather, pens, pencils, pencil sharpeners, plotting charts, in fact, all the life-support paraphernalia that I was likely to need on the firing point, including my leather shooting jacket, long-peaked cap and other accoutrements were all ticked off my check-list. The aforementioned Konsberg and a clapped-out P14, (why I was taking that, heaven alone knows,) all were carefully, nay, lovingly stowed away. Everything I could possibly need and things which provided a comfort factor, (all I needed was a teething ring,) but were not necessarily essential, was loaded for the forthcoming assault on the Bisley prize lists.

In all the previous nineteen years of attendance, never had I felt that I was 'in with a chance' as I did then.

The loading completed, I repaired to the range 'watering-hole', the Red Rose tavern-cum-canteen, more used for the former than the latter. It was there that fellow worshippers made dutiful supplication to the god Bacchus, at the close of day, having emerged from the day's competition in a near-sane condition. For some, the serious business of quaffing the landlord's finest could begin in earnest. As the mood became mellow and the varied stories of endeavour raised gales of laughter, one could look around the gathering and see many with their left arm outstretched, trigger finger crooked as they aimed along an imaginary barrel, providing animation as the latest misfortune was described to the many avid listeners. The police breathalyser had not yet been introduced and in those days, it was acceptable to drive in a semi-inebriated condition, if you could get away with it!

Restricting myself to a swift 'half', I bade farewell to the assembly and with the words, "See you down there," hanging in the air, I made my way to the car park and my vehicle.

It was a balmy early-summer evening, my guardian angel seemed to caress me and my world was a good place to be. An air of high expectation prevailed and my confidence level soared as I looked forward to the challenges soon to be met.

The engine fired on the first turn of the ignition key and I left the car park

Continued on next page

The Holy Grail

Continued

en-route for home. Seconds later.....

At the first corner, I reached out to prevent my two rifles sliding on a self-destruct path and I could hardly believe what my senses were telling me. My dearly beloved Konsberg, Serial No. 000136, was no longer there.

On-camp speed limits were violated, as I returned to the Range Superintendent's office, amidst a cloud of blue smoke and the smell of burning rubber, where details of the theft were related, via the 'phone, to the local police station.

In true SAS fashion, the local Gendarme arrived, about fifty minutes later, on his antiquarian Raleigh bicycle. His corpulent figure gave a surreal air of confidence to the whole scenario, as he took down particulars of the case. Returning his notebook to his left-hand breast pocket, he sought to reassure me, "Don't worry, laddie, we'll get it back for you." I haven't seen it from that day to this!

After the initial adrenaline rush and I had got myself used to the loss, I lodged an insurance claim for $185, the amount originally paid for my Konsberg.

Emergency plans, especially formulated only minutes before to deal with situations like this, were sprung into action. An urgent 'phone call to Arthur Clarke, gunsmith, (mentioned earlier,) and the question, "Have you got a Mannlicher in stock?" posed. It was a bit like ringing Derby and asking if they had a Rolls Royce! (The prices bore a remarkable similarity!) An answer in the affirmative received the response, "Take it to Bisley with you, I'll collect it from you there". For reasons best known to himself, the following Monday, four days into the Meeting, was his earliest time of delivery, so I just had to grin and bear it and struggle with that crappy P14, for all of Friday, Saturday and Sunday. A happy bunny I was not!

Numerous pieces of coloured paper, bearing the Governor of the Bank of England's signature and his solemn, "I promise to pay the Bearer..." passed from my hands into Arthur's and I became the proud, but poorer, owner of a rifle regarded by many as the ultimate shooting machine

As soon as was humanly possible, the rifle was zeroed in readiness for the next competition.

The newcomer to Bisley would imagine, with some justification, that a session on the zeroing range there would result in a zeroed rifle. Reasonable? Not so! It is as if some alien life-force takes control. Even though all the shots consistently hit the vertical line, through all the elevation settings, strange things happen during the first shoot proper thereafter.

Nevertheless, even though I was aware of this idiosyncrasy, I had to undergo the ritual, for the family sub-terranean vault had been plundered and a lot was expected from this inanimate assembly of walnut and steel.

With my family's best wishes ringing in my ears, I ventured forth, a trifle nervously, to the 600 yards firing point to take part in the "Wimbledon" competition. I will take the memory of ensuing events to the grave with me.

My group, (and I use the description loosely,) resembled to a remarkable degree a plan-view of a large, extremely large, pepper-pot. Dismay engulfed me as I pondered the graphic evidence of my plotting chart, and the thought that I had severely depleted the family coffers, for this, was not a comforting thought. It was not a refulgent example of the marksman's art.

Walking back to the caravan, I worried. I visualised the upturned beacon of innocence which was my young son's face, who thought his Dad was the "bee's knees". What was I going to tell him and my trusting wife?

As it turned out, their query was answered with, "Well, I got them all in there". I did not elaborate and tell them I was referring to the six feet square target and not the bulls eye! It was not really a lie, was it?

The first stage of the "St. George's" competition came and went on Tuesday morning and my miserable performances to date, (how I hated that P14 for bringing me to my knees,) had denied me a place on the County Team.

The morrow was the First Stage of the quest for the Holy Grail, (the "Queen's Prize",) and I was decidedly not exhilarated with the prospect. But I had reckoned without the variability of Radway Green ammunition, (it is essentially a military bullet, first and foremost,) and the NRA track record of keeping the best until last.

Half an hour before time, as is my wont, (it allows leeway to sprint back to the car park for forgotten kit,) I arrived at the 300 yards firing point for the first shoot in the long trek to the "Queen's Prize". More with a sense of relief than anything else, I arose from the shoot with a score of 33 ex 35. Many had fared worse! I just had to hold myself together and hope Lady Luck would stay with me.

I had to while away a couple of hours before the next 500 yards shoot and I tried to relax, yet remain focused, so I just wandered from Fulton's to Parker-Hale's premises, aimlessly, picking up bits and putting them down again. (I had spent enough already!)

The hour grew near. There was no putting it off. It was time to be counted. I glanced at the leadened sky and silently rejoiced. Shooting in the rain didn't bother me, (I should have webbed toes by now,) and I knew that others would allow it to detract from their concentration level.

I was squadded on the extreme left of Century Range, which only meant a short walk to my firing point. Minutes before the shoot began, the heavens opened in a manner befitting the height of the monsoon season in Kuala Lumpar and I was strangely comforted by it. The rain would reduce the severity of competition ranged against me as I sought to attain one of those coveted places in the next stage, still fourteen shots away. I moved easily into wet-weather mode, thankful that only weeks before, I had renewed my well-worn waterproof over-trousers.

Two sighting shots and seven scoring shots later gave me a score of 34 ex 35 and the spent husk of yesterday was now rejuvenated, ready to take on the world!

At 600 yards, it was like being on auto pilot. The bulls just kept coming and a 'full house' was the result. Seven scoring shots, seven bulls! I was walking tall and I felt momentary compassion for those of dejected appearance, I hope I was magnanimous in victory! My score of 102 was four points inside the cut-off figure. All this from a rifle that wouldn't shoot straight twenty-four hours earlier! It was totally unbelievable, but I wasn't complaining!

The Second Stage was held on the final Saturday morning of the Meeting, unlike now, and I think my score of 146 was achieved with 48/49/49, following two sighting shots and ten scoring shots at 3/5/600 yards. My records only show the total score! Nine others had the same score, five topped it with 147 and John Killian was top gun with a 148. The qualifying score went down to 142, all twenty-five of 'em. The original entry of 1097 had now dwindled to 100 and I was still in there, with a fighting chance!

This really was the time for seclusion and a darkened room, but I had lunch and a game of football with my son. What on earth would the team shrinks have to say about such a level of post-prandial activity? If nothing else, it ensured that my light repast was fully digested before the afternoon's baptism by fire commenced!

I girded up my loins, (not a pleasant sight, dear reader,) and sallied forth to Stickledown Range, where Queen Victoria had fired the first shot to herald the opening of Bisley, following the move from Wimbledon, by the NRA.

Trudging back from 900 yards to the 1000 yards firing point, I reflected on my shoot. I had fallen into a 4-5-4-5 sequence and I finished with a score of 68 ex 75. (we were now shooting two sighters, with fifteen scoring shots, at both distances.) The tortuous, capricious zephyrs of Bisley Common had exacted their toll! I thought it was a dismal effort.

On target twenty-five and shooting with Colin McEachran, my assigned partner, now at 1000 yards, I started with a crow, scoring three, followed by an inner for sighters. Taken from a photograph of the Register Keeper's chalked score board, my shoot is recorded thus; 5-4-4-5-5-5-5-5-4-4-5-4-5-5-4, for a 69 ex 75 and including my Second Stage score, gave me a total of 283. That last inner....!

Shooting alternately with me, Colin's fortune is illustrated by the following scoring values; 4-4-4-4-4-4-5-4-4-5-5-5-5-5-3, for a score of 65 ex 75. Oh, the pain of it. Not only was the knife thrust deep, the final twist of that magpie must have been excruciating!

"That's it," thought I. ''it's all over, at least, I'll get a Queens Hundred Badge!" Roll on next year! How many times had I said that, in past years?

I didn't believe it when Colin told me that I had tied for the Queen's Prize!! "Stay where you are," he urged. As far as I was concerned, my shooting had been mediocre and its only saving grace, as I saw it, was that no scoring shot had strayed further than the inner, which is no mean feat at Bisley, believe you me!

There was much to-ing and fro-ing by the NRA officials and after cards had been checked and re-checked, it was found that three others, Harriss, Fitzpatrick and Lawson had also scored 283. For the first time in the long history of the event, a tie shoot was to continue the agony. The screws were turned, hard! One more sighter, five more shots to count. Would it never end?

The first to count was a bull, followed by an inner and my toes curled in my boots. A bull, then an inner followed, (recognise the sequence-again?) I thought, when the second inner appeared, "I've blown it,' and the final bull was no consolation.

I started to rise and Colin, who was now register-keeping my score, with a note of urgency in his voice, said, "Don't get up, I think you've tied again!"

This was almost Walt Disney stuff and it was getting into the realms of fantasy, exhaustion was taking its toll. Here I was, late afternoon, having fired thirty-six shots in the morning, followed by thirty-four in the afternoon, all demanding 120% concentration. Not satisfied with that, my torturers had made me fire an additional six shots and it wasn't over yet! How I wished I was done with it!

Above the murmured conversation of the watching crowd, I heard Fitzpatrick and Lawson packing away their gear and Harriss, somewhere up the hill on my right, stayed put. The gauntlet was to be thrown down, yet again.

I don't think I was in the right frame of mind to go into a sudden-death situation and I accepted the single round as if it was a poisoned chalice.

Time passed and I tried to gather myself. Aim was taken and abandoned more than once, the sight picture was just not good enough. During these efforts, I noticed the wind strength had eased and I moved the backsight adjustment one and a half minutes right. On aim again, I heard Harriss's shot go on its way, but I was too tired to look at the result, as his target reappeared.

Now I had to do something, a shot was expected of me. The world sat on my shoulders, or so it seemed. The shot left me and I noted an upward movement of the foresight. I groaned. On a 10ft x 6ft Long Range target, there is not a lot of spare scoring surface above or below the bull.

"Don't let it be a crow, please..." was my silent prayer. I knew it wasn't a bull, but at least, it was all over!

The records show that Harriss scored a bull, me an inner. I had no-one to blame but myself!

I was so overwhelmed by events, I don't think I had the presence of mind to go over and shake his hand in congratulation. If that was the case, I offer my unreserved apologies, here and now. Better late than never!

Months afterwards, I heard on the radio a very interesting piece of news, which caused me to write to my insurance company, as follows;

Dear Sir,

Almost before ''Morning Cloud'' touched the sea-bed, Sir Edward Heath received $108,000 in compensation.

Would you please advise me how my very modest claim for $185 is progressing?

Yours faithfully,"

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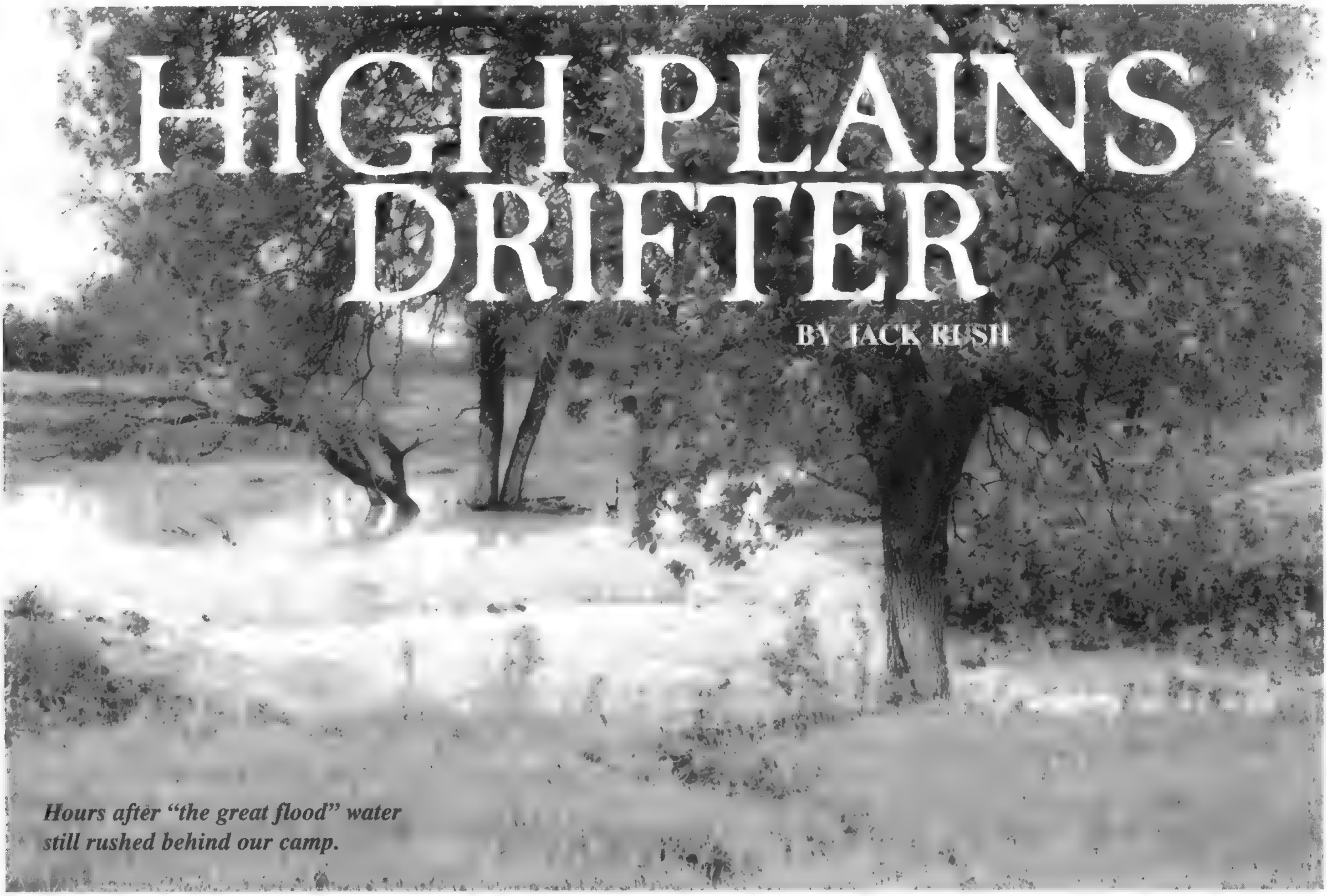
HIGH PLAINS DRIFTER

BY JACK RUSH



Hours after "the great flood" water still rushed behind our camp.

We had a few Clint Eastwood types drift through our Wyoming campsite, as usual, this year, but the drifter I refer to is the unrelenting Wyoming wind.

Wind is always the primary obstacle to long range connection, especially on the western plains. Never have I seen it so severe for so long. We viewed 30 MPH gusts as lulls in the storm. Throw in a cloudburst of four inch rain and you had the stuff that shooters misery is made of.

Bullet selection is the primary factor in high wind: the highest ballistic coefficient always wins, fine points of accuracy be hanged. Our group is not much into the specialty rifles of tight twist required for truly high (long and lean) ballistic coefficient bullets. Even my 250 Ackley Improved could not cope in such a gale. Bullets of 52 to 55 grains out of the 22/250's seemed to have a horseshoe shaped flight beyond 300 yards.

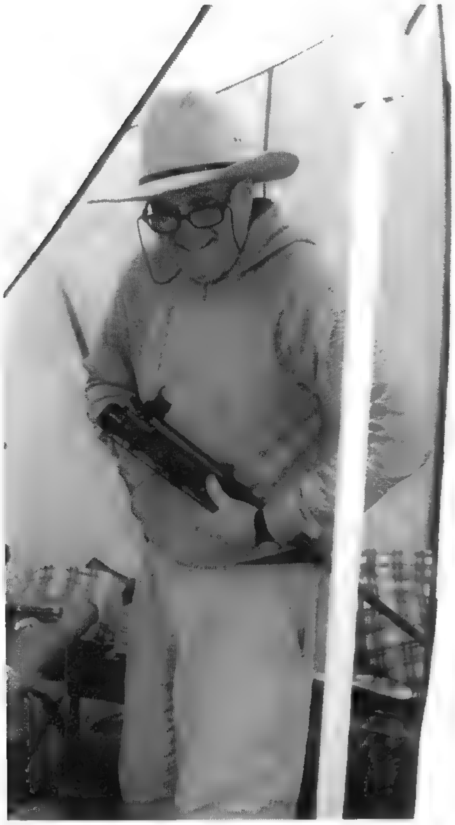
The impossibility of successful shooting over open, flat terrain drove us to the relatively flat bottomed, grassy ravines where dogs were plentiful. While windy, these areas were somewhat protected. The curving nature and thus limited visibility of these watersheds limited shots mostly to around 300 yards maximum.

Hardly a challenge for the "big" rifles; the .222's began to come out of the gun cases.

Two of the .222 rifles were old Remington 722 factory sporters. Both had been properly bedded, with a pressure pad exerting 8 or 9 pounds near the forend tip. Contrary to popular knowledge of what it takes to shoot really well, these old Remingtons commonly shoot a half minute or better when pressure bedded and fed a diet of something they like. These two rifles were no disappointment. I have personally rebedded one of those rifles twice. When freshly rebedded it shoots well into the half minute of angle category. Time and stress slowly cause the wood stock to relax a bit. Accuracy dwindles. Rebedding brings it back. It is hard to wear out a .222 bore, though a gradual creeping forward in the throat will eventually make it impossible to seat a bullet into the lands.

For the time being, these two rifles put on an impressive showing, despite being nearly a half century old. (I first bedded the one rifle 36 years ago for its second and current owner. This had been its second bedding job.)

Besides the two Remingtons, we had a Sako Vixen sporter of early vintage, and a Deluxe Kimber of Oregon sporter. The Sako has put on an impressive show for several years, being Carol Denzler's personal and only rifle. The Kimber was another matter, however. I purchased it new about ten years ago. It had a rather rough feel to the bolt, on closing, and the controlled feed could better be described as controlled jamming. Not typical of the product, it might well be described as a disappointment. The retailer who sold me the rifle took it to a gunsmith who chooses not to be named. He performed miracles on the smoothness and feed. It remained a mediocre shooter until I discovered 2015 powder. Then I got rid of lead tipped bullets. It shot match grade hollow points very well,



Salvaging Jack Freshwater's drowned 722.

and when the Nosler Ballistic Tips became available it became a deadly half minute varmint rifle out to 300 yards. I had thrown this rifle in while packing for this trip as an afterthought, as I had previously considered it to be a bit too "fancy" for a long and rough prairie dog outing. Thus the ammunition had been packed separately, and were the only cartridges undamaged by "the great flood" (more on this later).

These four rifles saved the day and made for a fine outing out of something that otherwise could have been a bit of a bust.

By the time our party had reached the Wyoming camp we had dwindled to four in number, natural disasters having cost us a couple of shooters back in South Dakota. Our hunt had actually begun in South Dakota, arranged by our friend, "Mr. Dog" Grable. We had selected a campsite on the edge of a babbling brook, under shade trees, and situated just below a large stock dam. For the uninitiated, a stock dam is a man-made pond to supply cows with fresh water during the dry summer months. This pond was fed by several deep canyons crowned at their origins by spectacular badlands spires. This private ranch is unsurpassed in beauty and rich in wildlife. Coyotes sing you to sleep at night, and an Eastern bluebird may wake you with song in the morning. (Editor: Just what the heck an Eastern bluebird is doing in South Dakota remains a puzzling question). Prairie dogs await your arrival, just over the first hill.

Jack Freshwaters and I had done a bit of scouting in the late afternoon, after setting up the camp. We spent a couple of hours shooting, and were casually observing great thunderheads building in the west. Back in camp there were a few murmurings of imminent bad weather. Lack of communication of our concerns, so typical of a group of men, perhaps contributed to the seriousness of the disaster to come. (Editor: Let's not get sexist here, Rush. I don't exactly need a bunch of men picketing the PS office).

In my mind's eye I could see the layout of the canyons that fed the pond. The earth dam was old and needed some repair. Jack Freshwaters had studied water for many years as field man and official with the U.S. Geological Survey, Water Division. Little did I know that he, too, had concerns. He had retired to his cot in his tent, carrying a large knife, prepared to cut his way out of the tent in case of emergency. I had retired to my pickup topper, being leery of sleeping in my tent on the creek bank. At the first drops of rain I retrieved my five double rifle cases from the tent, put them in my pickup and retreated to high ground.

It started as a gentle patter on the tin topper. By the middle of the night, all hell broke loose. Nearly four inches of rain fell in torrents, driven by high wind. Being an admirer of nature's savage fury, loving blizzards and wild summer storms (*provided I am safe*) the storm lulled me back to sleep. I had no idea of the drama evolving below me. (Editor: The gradually weakening screams were no clue?)

Pushing the topper lid open in the bright morning sun, the camp appeared serene and normal. Then I began to notice odd things. (Editor: bodies?) coolers and water cans strung out below camp along the prairie beside the stream. One object caught my eye. A wooden box containing some of my cartridges, weighing perhaps 50 or 60 pounds was lying below me, nearly a quarter mile down-stream from camp. I later learned that Jack had retrieved this out of the creek.

All of my ammunition, in 3 large containers, had gone under, only the largest and heaviest, nearest the creek had been swept away. All of my ammunition was wet and covered with fine silt. Jack's 722 had gone under and we

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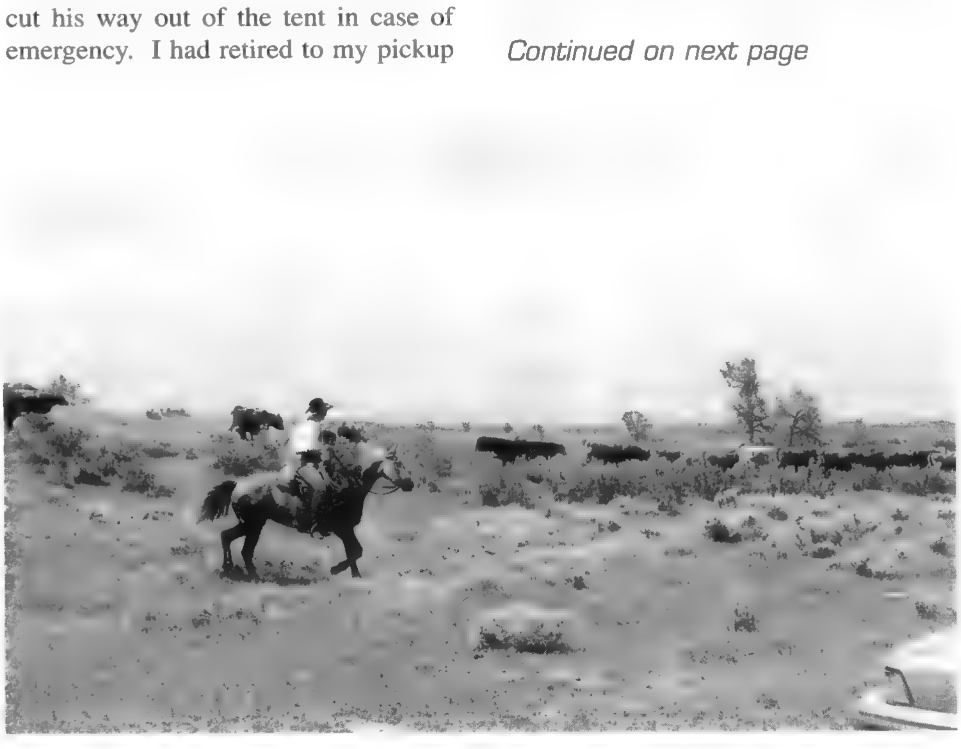

Cattle roundup through our Wyoming camp.

High Plains Drifter
Continued

spent some time disassembling, drying and oiling it.

All my clothes, which were stored in the tent, were wet. A Smith K 22 had gone under with them. The story was pretty much the same throughout the camp. The water had flowed through Buck Stacey's camper, leaving a layer of mud.

The dirt trail out of camp was a hopeless series of mud holes, impossible to negotiate with Denzler's large trailer. We spent that day wading ankle deep, salvaging and drying. (Editor: We understand that Robert Redford plans to make a movie out of this. It will be titled, "A River Runs Through It, Part II"). The following morning we threw our mess into vehicles and headed for Wyoming. Buck opted to stay behind, as he felt it would be very difficult to extract his camper from its moorings. He also had reservations about traveling another couple of hundred miles. Rich Grable had obligations to other hunters, and thus we dwindled to four.

A later critique of what had happened suggested that when the dam broke the great rush of water had created a jam in the creek, causing the water to rise very rapidly and fall again as rapidly, when the log jam broke.

Jack was asleep when the water rose to perhaps two feet deep in his tent, and he did not awaken. (Editor: We can only presume he slept on an air mattress, otherwise we are in awe of his ability to sleep underwater). Had he done so and panicked in the total darkness, he might have drowned. If he had cut his way out as planned, he might have gone the wrong way and been swept away. There were a lot of "what ifs" that fortunately did not occur.

If this sounds like a negative experience, it was not, as any day spent shooting is better than any day not shooting. Also, it was a very pleasant renewal of my acquaintance with the great little .222 cartridge. Would I answer the "if you could only have one caliber?" question with the .222 Remington? Likely not. It is a really fine caliber for average range shooting, and I was glad I brought it. Had the wind calmed a bit and I could have enjoyed the long range shooting, I'm afraid it would not have seen much use, as usual. I will never leave it home again, however.

By the way, I washed and dried 2,000 rounds after my arrival home. I had shot some of the wet and silted rounds by careful drying and wiping as I pulled them from the muddy boxes in the field. No misfires so far.

The Real World in Wyoming.

A rare calm in the Wyoming dog towns.

Practical bullet STABILITY

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Bullet stability is a measure of how well it keeps its nose pointed forward in flight. An arrow is naturally stable because its nose is heavier than its tail. Fletching with feathers improves stability by causing more drag on the tail

A typical bullet is naturally unstable; that is, if it were not spinning it would flip over and fly backwards. To prevent flipping, bullets are given enormous spin rates which provide sufficient gyroscopic stability.

Bullet muzzle velocity and barrel twist rate determine spin rate. As a simple example, a twist rate of one turn in 12 inches produces one revolution per foot. At 3000 fps, this yields 3000 revolutions per second or 180,000 rpm!

The "rotational inertia" resisting tipping increases with the "square" of its spin rate. Thus, increasing barrel rifling twist from one turn in 12 inches to one in 10 increases stability by: (12/10)x(12/10)= 1.44, or by 44%.

Analysis of gyroscopic forces is somewhat advanced and is quite difficult to explain in elementary terms. I shall try, however, to clarify the significant analytical results.

When a twist or torque is exerted tending to tilt the spin axis of a spinning body, it resists this and rotates, instead, about a perpendicular axis. The front wheel of a bicycle is a good example of this. If you lean to the right while rolling forward, the front wheel turns to the right instead of tipping. Toy tops provide even better examples.

When I was a boy in the early 30's, large tops were very popular. Most were some 6 or 7 inches in height and in diameter. A threaded center shaft, when pushed down caused it to spin. By pumping hard and fast, it could be spun so fast that it whistled a nice note. Later we graduated to small, solid tops. A thin cord was wound around near the bottom. When expertly slung towards a smooth floor, as the cord unwound and released, it spun the top at a high rate.

By watching a top carefully, many of its unusual properties can be seen. When released not quite vertical, the center or spin axis "precesses" rapidly around in a small circle which decreases to a "sleeping" mode. As it slows, however, the circle widens and it also "nutates" or nods above and below that circle until finally falling.

That is an apt description of what happens to a marginally stable bullet after it comes out of a rifled barrel. The force tending to tip the bullet over is air drag instead of gravity as is the case with a top. When it is tipped slightly, a small component of this drag force thus tends to tip it over. Typically, air drag on a bullet is about 70 times as great as the force of gravity.

A top is pivoted about its point of contact with the floor; the "moment arm" producing the torque by gravity pulling the spin axis down is the radius of its precession circle. As its spin rate decreases this radius and the torque thus increase steadily until it falls.

A "free gyro" like a bullet tends to tip about its mass center or "center of gravity" Cg when acted upon by drag which, in effect, acts at its "center of pressure" Cp.

Unlike a top whose spin rate slows down, the drag force tending to tip a bullet decreases much more rapidly than its spin rate. Drag on a typical bullet decreases about 13% per 100 yards; after 500 yards, drag is thereby reduced by about half while its spin rate decreases very little. Hence, a bullet's stability increases steadily as it goes down range.

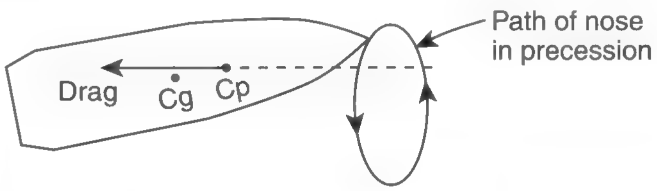
From the standpoint of stability, a key factor in the design of a bullet is the relation between its Cg and its Cp. The centroid of the volume or the Cg of a homogeneous cylinder is at its middle or the center of its spin axis.

The Cp is the point at which, if all drag force were concentrated, would dupicate the effect of drag. This point is the "centroid" of the bullet's cross sectional area which for a cylinder is also at its center.Since the Cg and Cp are at the same point,a homogeneous cylinder is neutrally stable

For a tapered body the Cp is "in front of" the Cg. For a cone of height h, for instance, the Cp is at 1/3 h (from the base) but the Cg is at 1/4 h. Since its Cp is in front of the Cg by (1/3-1/4) or 1/12 h, frontal drag if slightly off-center, tends to tip it over. All such tapered shapes are unstable in that they naturally prefer to go tail-first. In most bullet shapes the Cp and Cg are quite close together

Just as a cone can be "generated" by rotating a symmetric triangle about its central axis, a paraboloid is generated by rotating a parabola about its central axis. Since their nose cross sections are rounded rather than straight, most bullet noses are much closer to being paraboloids or half-ellipsoids than cones. For a paraboloid, Cp-Cg=2/5 h-1/3 h= 1/15 h, which is less than that of the more slender cone, hence more stable.

Bullets generally comprise a cylindrical center section, a tapered nose and, in boat tails, a short tapered tail section. I analyzed such a composite shape. Its stability properties, as expected, compare closely with tests performed by the US Army and others. The figure below shows such a bullet shape.



Precessing Bullet

Briefly, for a composite body consisting of a cylinder and a paraboloid, each of length L/2, the Cp is at 0.431 L and the Cg is at 0.389 L,from the base. Hence Cp-Cg= 0.041 L or about 1/25 L. Recall that for the paraboloid alone, Cp-Cg=1/15 L. Hence adding the cylindrical section reduces Cp-Cg which increases stability.

To analyze the effect of length, I doubled the length of the cylindrical part of the above composite. In that case I found Cp-Cg= .0416 L, a trivial difference of.0005 L! We thus find that increasing the cylindrical part has little further effect on Cp-Cg.

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Practical Bullet Stability

Continued

Thinning or lengthening the nose section decreases stability, however. A rounded nose cross section like a parabola rather than the straight lines of a cone increases stability. A shape in which the tail is tapered just like the nose is obviously symmetrical and stable like a cylinder

Hence, adding a tapered heel improves stability slightly since it makes the total shape more nearly symmetrical.

The above analyses assume homogeneous bodies made of materials with the same density, from tip to tail. Bullets are generally made of a lead alloy covered by a thin brass jacket. The density of lead is 11.34; brass has a density of about 8.2. The density of a typical lead bullet covered with a thin brass jacket is thus about 11.0, meaning that it is 11 times as heavy as the same volume of water.

Stability can be greatly improved if the tail section is made of a lighter, less dense material such as brass. A bullet shaped like the above composite but with the rear cylindrical part made of brass would be virtually stable and adding a tapered heel or boattail could make it stable!

The density of aluminum is only 2.7 or less than 1/4 as dense as lead.If stability is a critical factor,designs such as Nosler partition bullets could be made very stable if the tail sections were filled with aluminum instead of lead.

Analysis of Gyroscopic Stability and Twist Rates

Before discussing rotational motion there are a few concepts, unfamiliar to most people, that must be explained and terms defined. Just as mass M is the "inertial" property of a body that resists linear motion, "moment of inertia" I is the spin or rotational inertia property of a spinning body that resists the tipping of its spin axis. The change in angular momentum due to the torque is a rotation or precession of the spin axis in a circle about the line of force, analogous to the change in momentum or acceleration due to a linear force.

Recall the fundamental Newton relation between force D, a mass M and its change in velocity: $D= MxdV/dt$.

The equivalent relation in circular motion is: $T=(Ixw)xW$, where T is torque, W is precession rate and Ixw (angular momentum) is its spin rate "squared" w times $I= Mxk$.

The "radius of gyration" k is the radius at which, if all the mass were concentrated, would have the same I.

A top or gyroscope exhibits three motions, its spin w, its precession W and nutation or a "nodding" up and down of its precession circle. A complete description of these motions is difficult to analyze mathematically. It requires using a "Lagrangian" formulation in terms of total energy. This yields a cubic equation in the tilt angle and its rate of change. Solutions are in terms of advanced functions called "elliptic integrals".

In summary, there are two precession modes. Below a critical spin rate, "slow precession" with nutation occurs. This slow precession mode deteriorates rapidly. The "Fast precession" mode, in tight circles, is needed for stability.

This critical spin rate, wc, depends on several factors:

$$wc= 2/Is /Io\ D\ (Cp-Cg), \text{ where:}$$

D= drag force, Is is I about the spin axis and Ic is I about an axis perpendicular to s through the Cg. Thus, increasing Is by increasing bullet radius and/or decreasing Ic by decreasing its length, as well as decreasing (Cp-Cg), decreases critical spin rate wc and increases stability.

The "fast" precession rate: $W= (Is/Ic)\ ws$. For typical bullet shapes, Ic is about 10 times Is so that W is roughly 1/10 as fast as spin rate ws. Thus for ws=3000 rev/sec, W=300 rev/sec, or about 1 rev per 10 feet of bullet travel. This agrees closely with rates measured by studying the shapes of bullet holes made in a series of thin targets.

When a bullet leaves the barrel, ideally it is pointed in the direction of its velocity. Precise machining of the last inch of a barrel is critical for stability since the initial tilt error determines the size of its initial precession circle. A bullet with sufficient spin slowly rights itself, however, and "goes to sleep" a short way down range. As drag decreases, stability improves farther down range, as mentioned earlier. Increasing spin increases the time it takes for the bullet to right itself, however. Thus too much spin is also not desirable.

Typical Spitzer shaped bullets from barrels with rifling of 1 turn in 14 or 15 inches have stability factors of about 1.0 which means that they are marginally stable. Increasing turn rate from 1 in 14 inches to 1 in 10 would increase the stability factor S by $(14/10)^2$ or from 1.0 to about 2.0. An S between 1.5 and 2.0 is ideal. An S greater than 3.0 is not necessary and can decrease accuracy slightly.

An Historical Account of Gyroscopic Precession

The rotating earth is a huge precessing "free gyro". This has a fascinating history. The ancient Greeks had noticed a slight motion of the stars. By the 16th century, the great Polish scientist/cleric Nicolaus Copernicus noted that this apparent rotation of the heavenly canopy of stars had grown to more than 20 degrees. He had already figured out that the earth rotates about its axis once each day and that it is tilted 23 degrees. He had further figured that as it goes around the sun in a year, the north pole is tilted towards the sun in summer and away in winter, giving rise to our seasons.

Copernicus was convinced that all of the apparent motion of the sun and stars was due to earth motion. By superhuman analysis, he deduced that this apparent stellar rotation could occur only by a very slow precession of the earth's axis, always at 23 degrees, of one turn in 26,000 years!

He did all of this with a crude protractor, a plumb-bob, his naked eyes and thousands of hours of patient analysis. In spite the fact that he was precisely correct, he was vilified by Conventional Wisdom of the day and his great treatise, De Revolutionibis, was banned for some 300 years.

A century later, Galileo, seeing the moons of Jupiter and the changing crescent shape of Venus through his new telescopes, proved that Copernicus—The Master—was indeed correct! For this, after his infamous trials, he was convicted and placed under house arrest.

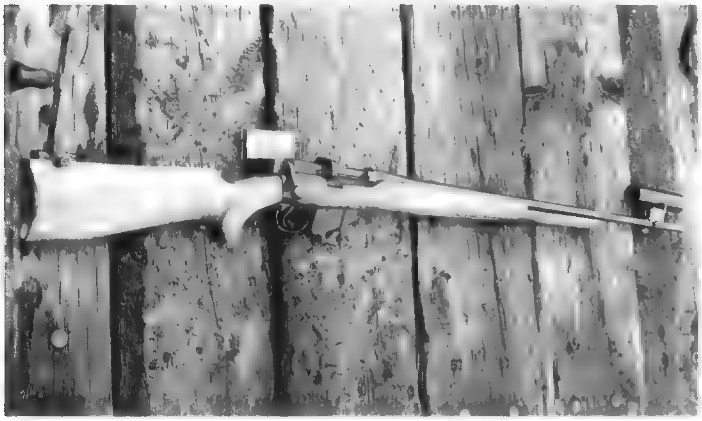
A few decades later, in 1687, Isaac Newton in his monumental treatise called The Principia developed the whole field of mechanics, including gyroscopic motion. He also proved that this slow precession of the earth is due to the attraction of the moon on the earth's equatorial bulge.

It can thus be said that the earth's precession was solved by the combined effort of the two greatest scientific minds of all time. Copernicus showed us HOW it happens and Newton showed us WHY it happens. A great admirer of Newton once said, "Nature's laws lay hid in night. God said, 'Let Newton be' and all was light."

Twenty-Two L-O-N-G Rifle!

BY CHARLES F. YOUNG

A picture tells a thousand words. That's what the Editor says anyway. Either that, or he's a comic book fellow who prefers pictures to words. Whichever, he is ever encouraging us to produce pictures. Which sometimes isn't so easy. It's one thing to set up the word-processor on a dark wet evening, but another matter to organize photographs. Here are some.

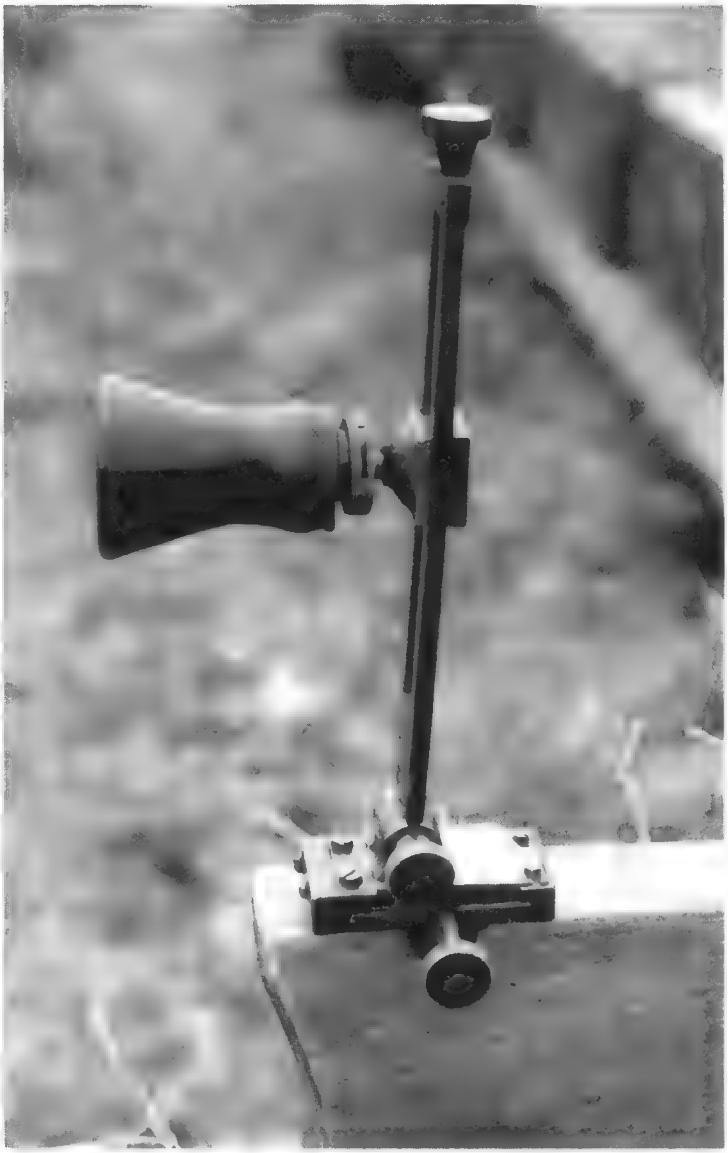


It's a 22LR SMLE, with the barrel clearly marked as BSA (Birmingham Small Arms) 303 Magnum. It is sleeved down to 22 LR, and it is therefore a long 22 LR, at some 30 inches or so. The fore-end wood is original SMLE chopped a little, but the butt is home-made. You can see the hole in the butt where the bolt fits through to hold it to the socket of the action. The hole is very low compared to the original, so the butt can sit that much higher. I bet whoever made this butt had a lot of fun drilling that hole! I wonder if he managed it the first time?

The MAGAZINE is just an empty box. It collects the fired cases very neatly.

The sights are Galilean system, magnifying.

The FORESIGHT tunnel contains a 0.5+ dioper lens, upon which is painted a circle with a hole in it for the aiming element. I t also contains a spirit-level bubble to help eliminate cant. The whole foresight can be removed for transit, being fitted to the barrel by a twist and turn motion to engage it to a lug on the barrel from BEHIND the lug. Thus, recoil makes the sight fit tighter to the barrel.



The REAR SIGHT folds down flat forwards, thus when shooting doesn't poke you in the eye. Basically, when the rifle fires and recoils, the sight stands still. The effect is to fold it down every shot. This doesn't happen in the 22LR version shown.

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Twenty-Two Long
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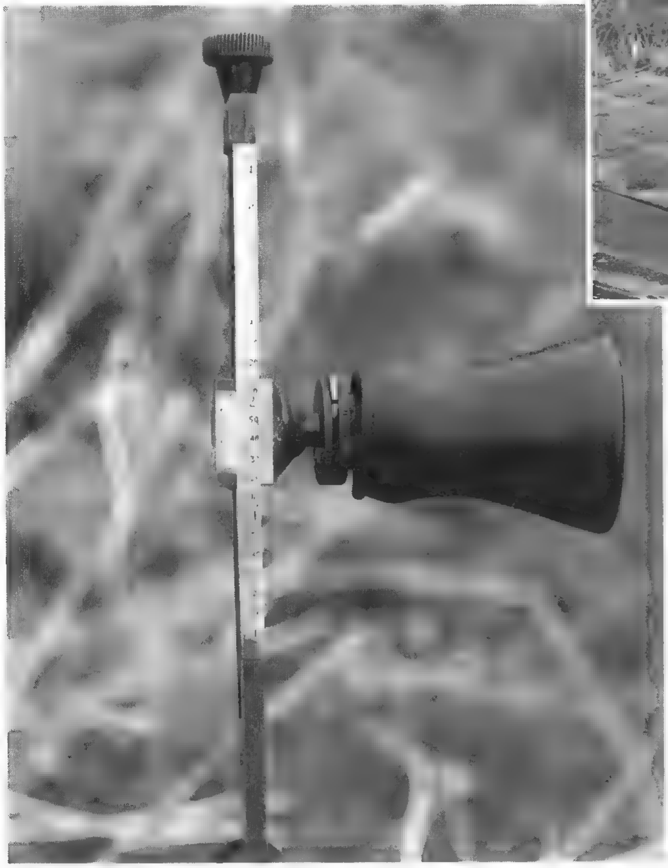
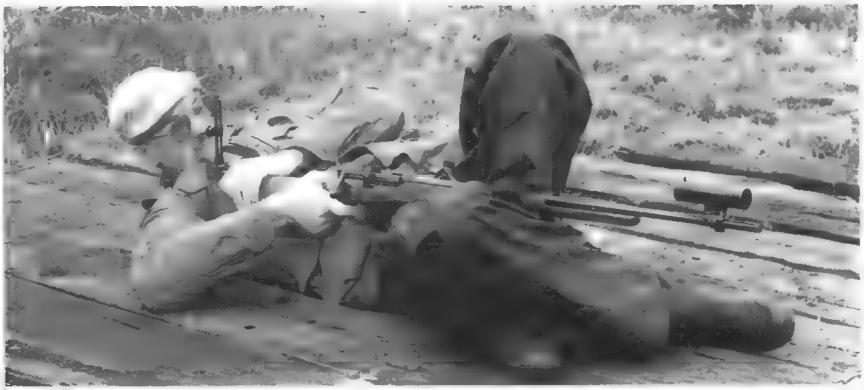
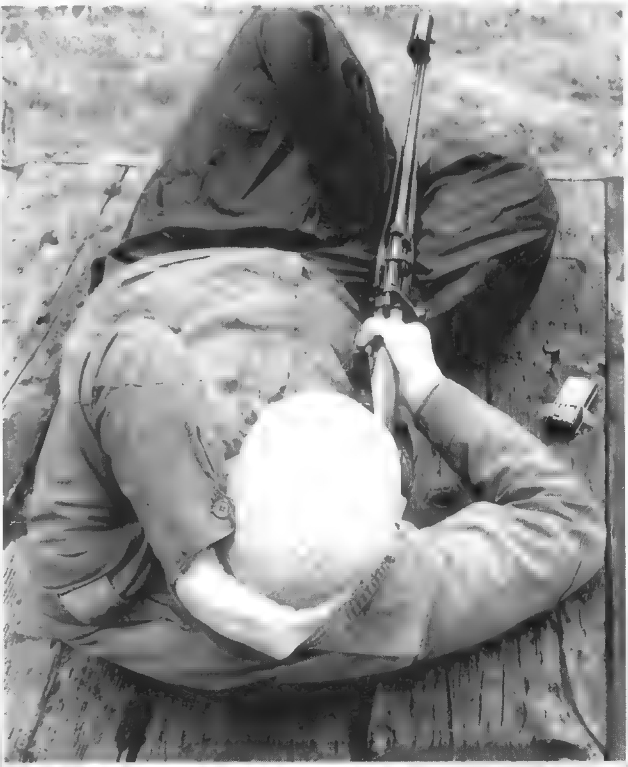


As can be seen, the rear sight is graduated from zero to four degrees. To hit targets at 100 yards we needed to set one degree and thirty-five minutes, more or less as shown. For 200 yards, we started hitting the paper in the black bit-sometimes-when we upped the sight to about two degrees. There are no clicks in this sight, so one needs to be adept at reading the scales fast. The upper screw of the backsight base tightens its pivot to eliminate slackness. The eyepiece is a typical British 6-hole job, notorious for wrecking groups by not getting the circular peep-hole plate properly latched by its detent hole. Some shooters fit a small lens in the backsights of Galilean sights to aid vision, known as a clearing lens. Most shooters don't need to. Magnification is about 2 1/2 times.



This is a BACK-POSITION rifle. The pictures show two ways to hold on. There are others. Holding one's head up and still is the problem. Shooters would usually sit up between shots. The pictures posed John Potter, owner of the rifle. Notice John's careful choice of clothing to protect him from the typical summer weather we get up here. And sunglasses! This doesn't mean to say that CANT is impossible, and despite the bubble, one can clearly see John canting to the left by 4 or 5 degrees in the picture taken from behind.



If all else fails, an alternative shooting position and sighting method can be used.

Bunnies Beware!

Regarding Bullet Pull & Seating Depth: How Much is Enough?

BY M.L. MCPHERSON

Synopsis: *Regarding correct bullet pull and minimum seating depth: Perhaps we need to say a bit more . . . . I have planned a study where we will be comparing loads using various interference fits between bullets and case necks. Meanwhile, we will try to answer these questions in a general way.*

Gun writers have spilled much ink in the pursuit of an answer to this age old question: "How close is close enough?" Fine, most of us now know that in precision handloading, as in most relationships, a bit of separation between partners is the best bet. For typical varmint and hunting handloads and guns that chamber those rounds, nominal tolerances lead to a rough estimate of 0.020" for a "best guess" as to the correct amount of bullet-to-rifling jump. When both gun and load components are a bit more precise, less bullet jump can work better and some combinations work best with the bullet jammed fairly tightly into the rifling.

Two relevant cautions are fully in order. First, contrary to what certain recognized "authorities" have written, seating a bullet into the rifling will almost always dramatically increase chamber pressure. Typically about 30%! When one realizes that such an increase in pressure represents the separation between typical SAAMI maximum loads and typical SAAMI proof loads one can see that this effect is most significant. Further, due to the interaction of the bullet and the rifling regarding static versus sliding friction modes, this pressure increase is not reflected by a commensurate increase in muzzle energy and is, therefore, not readily apparent.

I will give one example: A 280 Remington load that works perfectly in my Remington 7600 Pump. In that gun this load has about 0.030" bullet-to-rifling jump and generates very modest pressures. The 120 grain bullet produces about 3000 fps with a typical charge of slow burning powder. To chamber one of those loads in a different 280 barreled rifle, one featuring a particularly short throat, I have to drive the bullet about 0.020" into the rifling. Upon firing the load in that gun, resultant pressures are too high to admit, no doubt exceeding proof loads! The cases are ruined — an experiment I will not deliberately repeat. Note that reseating the bullets 0.040" deeper renders loads generating perfectly normal pressures when fired in that short-throated rifle.

(This is not an indictment of loading with the bullet into the rifling. If the powder charge is reduced accordingly the process is generally safe when using typical gilding metal jacketed or lead alloy bullets.)

The second caution regards solid copper or solid copper alloy bullets. With these numbers, seating the bullet with less than about 0.050" jump to the rifling is generally not conducive to optimum accuracy. What is more important, these bullets can raise pressures dramatically when seated too near or into the rifling. The polite terminology is "pressure excursion." Since you cannot know the actual pressure rise — as noted above, the increase might not be reflected by a commensurate increase in muzzle energy — you are at the mercy of your ability to judge pressures. . . . Regarding seating such bullets closer than 0.050" to the rifling, my best advice: Do not do it!

Now, the question of the day is this: "If we can suggest a reasonable starting point for bullet-to-rifling jump, why can't we suggest a reasonable amount of interference fit between the case neck interior and the bullet shank, i.e., bullet pull?" The simple response would involve a bit of hand waving, perhaps a captioned cartoon or two, a disclaimer that all guns are a law unto themselves and, finally, that a general answer to such a question is therefore impossible. The truth is, we have simply not studied this question sufficiently; more correctly, while ammunition manufacturers, various military ballisticians and plenty of precision handloaders have done this type of study, no one has adequately publicized any results. In responding to this question, I will also touch on a related question: "How deep should the handloader insert the bullet shank into the case neck?"

With the advent of increasing popularity and availability of moly-plated bullets the question of proper bullet pull takes on a new significance. Many shooters are discovering that the 0.001"-0.0015" interference fit that had given sufficient bullet pull for accuracy with standard gilding metal clad bullets does not work when those bullets are moly-plated.

Typically, to achieve consistent velocities and accuracy when using moly-plated bullets one will have to decrease expander ball diameter one-to two-thousandths of an inch, compared to the same load with non-plated bullets. This fact is a simple consequence of frictional differences — both static and sliding. Moly-plated bullets are about three times slicker than naked gilding metal clad bullets. When comparing copper bullets (read Barnes-X) frictional difference is much greater.

Now, finally, to the question of how much friction one needs to use: First, we should note that one reason authoritative accuracy pundits have not heretofore much explored this question in print relates to the difficulty of quantitatively measuring bullet pull. Soon, we hope to do a study where we can assign calibrated numbers to bullet pulls and relate those values to typical case-neck expander-ball diameters. We will also measure the resulting ballistics. Trouble is, this study will apply to one caliber and one load. Therefore, it will only yield a situation-specific answer. However, it will, perhaps, provide fodder for comparison. (In this business we do not do science, we make instance-specific observations and all-too-often expound broad generalizations.)

Another thing we have to explore mildly before we can properly answer the question of "how much bullet pull is enough" is this: "Why do we need any bullet pull?" Here I have a very definite opinion, based on a little experience, a bit of scientific fact and a measure of common sense.

The reason we need some bullet pull: Lacking any resistance, the primer's blast will dislodge the bullet significantly. Under that circumstance, where the bullet ends up, before powder ignition has generated sufficient chamber pressure to begin

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Regarding Bullet Pull

Continued

accelerating the bullet, is an open question. With limited bullet pull we could not expect the primer's blast to locate each bullet at the same place in the chamber or barrel before powder ignition finally generated sufficient pressure to begin accelerating the bullet in spite of the frictional effects of the bore and the case neck and the bullet's inertial resistance. Specifically, the boiler room will not be uniform and neither will the various bullets' frictional and deformational resistance. This fact likely explains why many of the best bench rest loads work with the bullet seated into the rifling. This approach effectively prevents any bullet movement as a result of the primer's blast. This analysis also might explain why the best bench rest cases use a smaller flash hole — that feature reduces the effective brisance of the primer's blast, which is, therefore, less apt to dislodge the bullet.

So, on the face of it, it is tempting to suggest that the proper amount of bullet pull, a priori, is simply all one can consistently achieve without distorting the bullet. However, realistically, it is very difficult to visually observe if seating stress has distorted a bullet enough to affect accuracy. Nevertheless, all that is required for one to test for this condition is a bit of range time.

Assume that one loads several batches of ammunition — loads varying only in case neck tension used, i.e., bullet pull. Then, assume one sees the following progression as one fires those loads. Starting with the lowest bullet pull test sample and working to the highest bullet pull test sample (those loads where one utilized a standard sizing die without the expander ball): Mean velocity increases; standard velocity deviation decreases; accuracy at first improves and then falls off dramatically.

Such an example would be reasonable evidence that increased bullet pull improved the load's consistency. The limiting accuracy level would suggest the point where case neck tension was beginning to significantly upset the bullet. In the same hypothetical test, if standard velocity deviation also dropped off when accuracy dropped off one might surmise the same cause: Bullet deformation reducing ballistic uniformity. This latter result would not suggest too much bullet pull was directly detrimental to either consistency or accuracy.

So, what is proper bullet pull? I certainly do not know. I can suggest that more is better unless accuracy results demonstrate otherwise. Also, if increased bullet pull does not result in a more accurate load, one likely explanation it that the bullet is not supporting the stress associated with bullet seating — the friction associated with neck-to-bullet tension exceeds the bullet's strength. In this situation the next order of business is to use a bullet seating stem that more properly fits the bullet's ogive. (Another explanation is that the case necks are not uniform, that some are generating more bullet pull than others and that this difference is exaggerated in the high pull loadings.)

One can easily fashion a properly fitting bullet seating stem. First, locate a proper diameter stem that almost fits the bullet's ogive, preferably a seating stem where the bullet touches only at one radius on the bullet's ogive. Then, select a typical bullet of the type in question.

If the bullet has a hollow point, fill that with a dose of quick-setting epoxy and form a flat point even with the opening of the jacket — a homemade meplat (this word is French in origin, and is properly pronounced meh-play).

As the epoxy in this gauging bullet cures, thoroughly clean the seating stem's hollow cavity using alcohol and a cotton swab. When that epoxy is sufficiently cured, coat the bullet's tip and the interior of the bullet seating die — especially the case neck supporting section — with a thin layer of Vaseline.

Mix a batch of high-strength epoxy putty (this product will not run as it cures) and place enough of this into the clean and dry bullet seating stem to entirely fill the nose cavity. Insert the bullet fully into the stem by hand. Remove the excess epoxy putty that the bullet drove out of the seating stem. Remove the bullet from the stem. Screw the stem into the bullet seating die. Place the gauge bullet into a prepped and sized case neck and very slowly seat it with the epoxy-filled seating stem installed normally in the die. Do not remove the case from the press. The idea is to have a properly aligned bullet supporting the epoxy in the exact shape of the bullet's ogive until the high-strength epoxy cures. After the epoxy cures it might be necessary to disassemble the stem from the die and do a bit of clean up to remove any epoxy that might have infiltrated between the bullet and the neck support section of the die or elsewhere.

If you do this well the stem will exactly fit that bullet. Such a bullet seating stem will provide the maximum possible structural support to the bullet during the seating operation. Thereby it will maximize the seating force one can apply without distorting the bullet sufficiently to affect its accuracy potential.

Obviously, case neck thickness and hardness will effect the relationship of bullet pull and interference fit between the bullet and the case neck interior. Therefore, one should strive for uniform neck thickness and hardness. Read this as a blanket advocation of neck turning and neck annealing for all precision handloads.

If that is clear we can move on to the question of bullet seating depth. Here the answer is very simple. Only the ability of the case to properly hold the bullet and the ability of one's tools to seat the bullet squarely in the case neck constrain proper and correct minimum bullet seating depth.

Realistically, bullet seating depths less than about one-half of one bullet diameter do not work well. Such loads are entirely too fragile for normal handling. Further, those loadings seldom seat the bullet squarely to the axis of the case. Even when one uses superior bullet seating equipment, it is exceedingly difficult to get a bullet to start perfectly squarely in the case neck; however, as one seats the bullet deeper, it will spontaneously align progressively more squarely in the case neck. The deeper the better.

On a related question, deep bullet seating, it is generally not good to seat the bullet shank below the bottom of the case neck. Sometimes this seems to do no harm, other times ballistic uniformity is dismal. As one example of why this might be, consider a compressed powder charge with such a load. As the bullet shank extends into the case body the powder is generating hundreds of psi pushing against the bullet shank where it extends below the bottom of the case neck. It seems reasonable that sometimes the powder on one side of the bullet might push harder than that on the other side and thereby might push the bullet out of alignment. For whatever reason, this type of load often gives poor accuracy and lousy uniformity. But, as noted, there are always exceptions.

I wish I could give a number one could hang one's hat on. Perhaps someday. . . . For now, polish down an expander ball in progressive steps and see what diameter gives the best results at the range. When using a different bullet, be prepared to use a different size expander ball. Softer and thinner jacketed bullets will not support as much seating resistance.

A SHORT *History* OF PETER PAUL MAUSER AND HIS RIFLES

BY HAP ROCKETTO

Like the uncounted numbers before and the uncounted numbers who would follow, the twenty-one year army conscript stood rigidly at attention. His neck was chaffed raw by the rough wool collar of his newly issued tunic and his feet were clamped in heavy high boots. His hands tightly gripped the wood stock of his rifle. Despite the discomfort of the galled on skin his neck and the possibility of worse discomfort at the hands of the non commissioned officer standing at the front of the formation, he could not resist the temptation to slightly tilt his head downward and to begin to carefully examine the rifle, then considered almost a military secret, held diagonally across his chest.

Until this time Peter Paul Mauser's life followed the typically orderly Teutonic path similar to the young men of his time, social class, and country. He was born June 27, 1838 in Oberndorf am Neckar, Germany and given a basic education in public school. Upon completing elementary school in 1852, he was apprenticed in trade, that being the same as his father, gunsmithing. He was placed in the workshops of Obendorf's government firearms factory where he labored at learning his craft until called to the colors.

Assigned to an artillery regiment, young Mauser would have a great deal of time to become intimately familiar with the strengths and weaknesses of Nicholas Dreyse's *Zündnadelgewehr*, or needlegun. Upon completion of his active duty Mauser returned to Obendorf and resumed working under the direction of his father, gunsmith Franz Andreas Mauser, and several of his twelve older brothers at the Royal Württenberg Rifle Factory. Mauser soon completed his apprenticeship training and turned his mind to firearms design, in particular the improvement of breechloading arms. After a less than successful attempt to market a breech loading cannon, he directed his considerable talents to developing a bolt action rifle.

Paul, and his older brother Wilhelm, began a sometimes tumultuous business relationship soon after Paul completed his training. It was to last until Wilhelm's untimely death at the age of 48 in 1882. While Paul dealt with development and manufacture, his older brother managed the financial and marketing of the partnership. Early on in their on-again off-again relationship, the two brothers managed financing to purchase tools and machinery to establish a workshop. There Paul devoted most of his time trying to cure two of the needlegun's biggest shortcomings, gas blowback and an alarming tendency for accidental discharge to occur as the bolt was being closed.

Young Mauser's older brother, Franz, had emigrated to the United States and obtained a position with Remington Arms. The United States firearms industry was a virtual cornucopia of new ideas and developments in the antebellum days leading up to the Civil War. This was the day of the likes of Spencer, Henry, Dahlgren, Colt, and Maynard. The Mauser brothers were soon exchanging letters at a furious rate, giving Peter a direct pipeline to the innovative ideas generated by the wartime expansion of the arms industry. From his older brother he was able to learn much about metallic cartridge theory and application. This insight lead Mauser to solve the gas blowback problem by simply adapting the rifle to use a metallic cartridge of his design rather than the more commonly used paper ones.

Accidental discharge of the Dreyse was caused when the long needle like firing pin would pierce the paper cartridge case as the bolt was being closed and strike the primer. Mauser redesigned the bolt to cock as the bolt handle was being lifted. This action drew the firing pin into the bolt body while it compressed the firing pin spring. The firing pin no longer protruded enough to cause accidental discharge. Additionally Mauser fabricated an extractor which pulled the expended cartridge case out when the bolt was withdrawn. Unfortunately, for the Mauser brothers, the Prussians believed the Dreyse to be the epitome of firearm perfection and would not consider changes. The Mauser brother's timing was just off as most of the principalities and petty kingdoms that made up Prussia had settled contracts for rifles with other manufacturers.

The first step in the development of a rifle is the design of the cartridge that will be used in the new firearm. He built upon his earlier cartridge work with the Dreyse to design a locking action that both sealed the breech of the rifle and was strong enough to withstand the great pressures generated by the new high powered metallic cartridges. The idea of a turnbolt style action was not the idea of

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A Short History ...

Continued

the Mausers but they perfected it to a point that there is no turn bolt action rifle created since that is not derivative of the original Mauser designs.

The Mauser brothers were shopping their new rifle around in 1867 when they fell in with Samuel Norris who, like brother Franz, worked for Remington Arms. Norris, an itinerant European salesman for the Ilion, New York firm, saw the great potential of the Mauser design and soon had a questionable contract with the brothers. Acting independently of his employers, Norris agreed to provide financial backing in return for a royalty on any rifles sold. He arranged for patents to be taken out in the United States and on June second of 1868 the newly styled Norris-Mauser rifle came to life. The irony of having the first Mauser protected by a United States patent would not be seen until long after the inventor was dead.

Remington was understandably upset with the renegade actions of Norris. As a knowledge of his shady dealings became public Norris was unable to raise the necessary capital needed to establish the Mauser plant, as he had agreed. He escaped from his contractual obligations with the Mausers by simply failing to provide the agreed money. Norris, in one fell swoop destroyed what might have been left of his reputation and a share in the fortune that would be generated by Mauser genius. And, while the Mausers no longer had a contract with Norris, their former partner had attracted the attention of the Prussian government.

The Norris-Mauser was a jumping off point for Mauser. The rifle was redesigned and it eventually won the approval of the Prussian government. A contract was soon let for what would become known as the Model 71 Mauser. The first Mauser rifles were originally manufactured in a new factory built in 1872 in Oberndorf. Soon after it's opening, the factory would be destroyed by fire, the first of three times that the Mauser Werke would be reduced to rubble. The second two occurrences happened during the two great wars that laid waste to Europe. As a result serious students of the company and its products have very little of the original records and artifacts for research.

Soon after the loss of the building the company recovered and was up and running with an order for 100,000 rifles. The factory was unable to handle the vast production and other arms making firms and government arsenals produced the rifle with each finished piece earning a royalty. The single shot Model 71 was manufactured for many countries with Japan and China purchasing the bulk of those exported. The rifle was chambered for an 11x60 mm bottle necked rimmed cartridge. The 385 grain bullet was propelled at 1440 feet per second by 77 grains of black powder. Production of this rifle ended after 12 years, in 1884, and while it was superseded by new models it remained in service for many years.

The Model 71 was upgraded in 1881, a year before Wilhelm's death. Mauser was an observer of world military affairs and was keenly aware of the results of poorly lead but well armed Turkish army over a superior Russian force at the Battle of Plevna. Under the generalship of Osman Pasha the Turks employed lever action Winchester repeating rifles to lay waste to a vastly larger number of Russian troops. The lesson was not lost on Mauser. He created his first repeating rifle based upon the Model 71 design and it became known, with the addition of a tubular magazine under the barrel, as the Model 71/84. The Model 71 was not retrofitted with the magazine but was rather a new rifle. While the rifle was only in production for eight years, from 1884 until 1888, it was a major advance in military firearms.

1500 Model 71S and 45,000 rounds of ammunition were purchased in May of 1914 at Hamburg and packed aboard the yacht Asgard moored in the harbour. The Asgard was owned by Erskine Childers. Childers, the author of *The Riddle of the Sands,* was an ardent Irish nationalist. After leaving German waters the *Asgard* met another vessel, the *Kelpie*, at sea and transferred 600 of the rifles. On July 26th, Childers conned the *Asgard* into Howth harbour. In short order they were moored and 900 rifles and ammunition were transferred to waiting taxicabs, much the same way French troops were rushed from Paris to the Marne, and taken to Dublin. At the height of 'The Troubles' these rifles armed the Irish Rebels during the Easter Rising of 1916 and are fondly remembered in the Irish Republic as the Howth Rifles.

Childers served gallantly during the Great War in coastal motor torpedo boats and intelligence, returning to his beloved cause of Irish nationalism after he was demobilized. In 1922 he was found with a pistol, given to him by Michael Collins. In the new Irish Free State, as when Ireland was under British martial law, the offense carried an automatic sentence of death. At dawn on November 24, 1922 Childers stood against a wall in Beggars Bush Barracks and moments before he died he told his firing squad to, "Take a step or two forward, lads. It will be easier that way." There is no record available to determine if any of the Mausers he had run into the country a few years earlier were used at his execution.

Germany adopted a new service rifle in 1888. Known as the Model 88 Commission Rifle it was not a Mauser, even though it incorporated various Mauser design features. Mauser was not in serious contention for this contract. He was directing his efforts to improving the Model 71. To that end the Model 88 experimental rifle came into being chambered for the newly developed Mauser cartridge, the 7.65mm, a strengthened action and a nine shot box magazine. The rifle was brought to various trials but attracted no real interest.

With the failure of the Model 88 Mauser directed his efforts to developing a new design. The result was a departure from the Model 71 with the appearance of the trademark Mauser one piece bolt with double opposed locking lugs. In 1889 the Mauser 7.65mm chambered rifle was adopted by Belgium and was designated as the Model 1889 Belgian Mauser. This was the first, but not the last, use of a country's name to identify a Mauser designed rifle. Interestingly none of these rifles were manufactured at the Mauser factory in Germany. They were all produced in Belgium or England. In the next few years the rifle was marketed at the Model 1890 Turkish Mauser and the Model 1891 Argentine Mauser.

In time Argentina, Bolivia, Columbia, Chile, Ecuador, Spain, Sweden, and Turkey would become adjectives to describe a model of the Mauser rifle. Siam, renamed Thailand, would be the only nation with both names used as a descriptor. In addition, Arabia, Brazil, The Congo Free State, Costa Rica, Ethiopa, Luxemburg, Greece, Iran, Liberia, Lithuania, Mexico, Peru, Poland, Serbia, Uruguay, Venezuela, and Yugoslavia would all use the Mauser to arm their troops. In the end about two dozen nations would fill the arms racks in their armories with Mauser rifles and pistols.

The Model 89 was a watershed development. It was the first Mauser to be designed for smokeless powder. It used rimless military ammunition in a five round detachable box magazine. This was the first instance where ammunition was loaded into the rifle by the use of a disposable metal charger. The more modern, and less accurate, nomenclature is stripper clip. While this describes what the device does it is not truly a clip. Like a charger, a clip is also expendable but it is loaded directly into the rifle and remains there until ejected. The eight shot en bloc clip which fits into the magazine of the M1Garand Rifle is an example of this type of device. A magazine is a cartridge holder, such as that used in the Colt 1911 pistol, that also fits into the firearm until ejected, but is not considered expendable.

Mauser continued to refine the rifle's design and this work brought about the most famous iteration, the Model 1893. This rifle had a redesigned bolt, improved safety, modifications to the trigger, a flush staggered column box magazine, and other minor manufacturing changes. Designed to shoot the 7mm smokeless cartridge the rifle was quickly snapped up by Spain and became known as the Spanish Model 93.

The Spanish Mauser would have a great effect on the development of a bolt action magazine fed rifle in the United States. On July 1, 1898, just five years after the Mauser's adoption by Spain five thousand United States Army troops, armed with single shot .45-70 Trapdoor Springfields and five shot repeating Krag-Jorgensens, swarmed up San Juan Hill. The seven hundred Spanish troops had two advantages. They were dug in on the top of the hill and they were armed with Spanish Mausers. In the ensuing assault thirteen hundred troops fell victim to the Mauser superior range and velocity. The mad hornet like sound of the 7mm bullet was the last sound that many of Teddy Roosevelt's Rough Riders ever heard. The handwriting was on the wall and within five years the Springfield '03 would become the United States' service rifle.

It was now that the irony of earlier United States Norris-Mauser patent became apparent. A close examination by Mauser engineers of the United States Krag-Jorgensen rifle, the Springfield '03, and its charging clips indicated that various Mauser patents had been infringed. After some negotiations, the United States agreed to pay *Waffenfabrik Mauser* a royalty of seventy five cents per Springfield '03 and fifty cents for each 1,000 clips manufactured, up to an amount of $200,000. Upon reaching that amount the United States government would have title to both the rifle and the charger.

Continuing the tradition of constant improvement, and naming rifles after the countries who purchased them, Mauser produced the Model 1894 Swedish Mauser Carbine and then followed it with the Model 1896 Swedish Mauser. The Model 96 sported more gas escape holes and a guide rib to make the action less prone to binding when the bolt was worked.

Peter Paul Mauser would introduce the rifle that would see action until the middle of the next century in 1898. The Model 1898 was the apogee of Mauser's development. He strengthened the bolt by adding a third locking lug, perfected the receiver ring, and fine tuned the trigger. Without a doubt the Model 98 is the definitive turnbolt action rifle. In various forms it served in combat from its introduction in 1898 through the end of World War II in 1945. Known officially as the Gew 98 it was more commonly, and affectionately, known to those who carried it as *das Braut des Infanteristen*, the Bride of the Infantry.

Raised in an atmosphere of extreme patriotism and fierce nationalism Peter Paul Mauser could have felt no greater pride then when his Model 1898 was adopted by his homeland to arm its soldiers. He died in his 76th year on May 29, 1914 in the town of his birth, just three months before the outbreak of World War I, a conflict which would see his rifle design ideas used on both sides of the battlefield. During his lifetime, and in ensuing years, few men cast such a long shadow in the field of small arms development as did Mauser.

A Note On Sources: The article was compiled from information gleaned from the following sources. Anyone wishing a detailed study of Mauser rifles, cartridges, and the personalities discussed are directed to these books. In addition, Mauser-Werkes maintain a site on the World Wide Web at http://www.Mauser-Werkes.com with a direct E-mail connection to Mauser-Werkes, PO Box 1349, D-78722 Oberndorf a.N, Germany. Their fax number is +49-7432-70-655.

Barnes, Frank, *Cartridges of the World 7th Edition*, Northbrook, IL, 1993

Campbell, Clark, *The '03 Springfield,* Piladelphia, PA, 1978

Childers, Erskine, *The Riddle of the Sands,* Annapolis, MD, 1991

de Haas, Frank, *Bolt Action Rifles*, Northfield, IL, 1961

Hallahan, William, *Misfire*, New York, NY, 1994

Hogg, Ian, *The Encyclopedia of Infantry Weapons of World War II*, Greenwich, CT, 1982

Kee, Robert, *The Green Flag*, New York, NY, 1972

Senich, Peter, *The German Sniper 1914-1918*, Boulder, CO, 1982

Smith, W.H.B., *Small Arms of the World*, Harrisburg, PA, 1966

Smith and Smith, *The Book of Rifles*, New York, NY, 1972

BARREL CONDITIONING & RELOADING FOR VARMINT RIFLES

(How Modern Developments Have Altered A Varmint Shooter's Methods, Materials and Techniques)

BY GENE SOLYNTJES

The first time I peered at the rifling in a quick twist barrel, I thought the gunsmith had made a mistake and threaded the inside, not the outside, of the barrel. Steve Kostanich had prepared a thirty inch long, 1 1/4 inch straight cylinder tube for me in 6mm-284, with a one-in-eight twist. The lands and grooves which appeared like threads for the quick twist meant that the heavy, streamlined VLD bullets for this bore would be revolving more than three times before they exited the barrel!

The purpose of the new barrel for my heavy varmint rifle was to utilize these VLD bullets for longer range accuracy, with less windrift than the lighter 6mm projectiles I had used. The Lilja stainless steel barrel seemed massive, and the longest I had ever owned. Steve Kostanich, the accuracy gunsmith, had been recommended to me by many shooters in the Northwest and I felt the VLD 6mm-284 was capable of higher velocities than had been reported previously.

Recent developments have enhanced much of the long range shooting for varmints today. Better barrels, stocks, portable shooting benches, scopes and reticules, new propellants, bullets more sophisticated reloading techniques, computerized trajectory tables and rangefinder devices have all helped. These devices have allowed accuracy at longer distance to become a distinct possibility for today's rifleman.

All these items put together cannot violate certain laws of physics, however. If you build a very accurate varmint riffle using benchrest techniques, you wish to attain high velocities and retain a high degree of accuracy. A varmint shooter wants the best of both worlds and it's difficult to achieve the twin goals. This dual requirement (high velocity and high accuracy) results in accelerated throat erosion due to the explosive powder combustion and blowtorch effects of unburned powder granules being blown through the throat and being ignited somewhere down the long barrel, needed to obtain the highest velocities that varminters cherish.

The vast varieties of both powders and bullets that have become available in the last 10 years have proven to be a bonanza for the handloader. Newer powders have filled gaps in the spectrum of burning rates which in turn has allowed certain cartridges to produce greater efficiency. Cartridges designed 40 and 50 years ago and declared to be "overbore," now appear to have potential for usage. Likewise, new bullets of more efficient design have produced better accuracy at increasing distances which were unrealistic for varmint hunters to attain as recently as a decade ago.

One of the cartridges which has benefited the most from the developments has been the 6mm-284. With its larger case capacity in comparison to the .243 and 6mm Remington, the 6-284 has been in existence since 1962. A "wildcat" made from standard .284 Winchester case, reduced in neck size to 24 caliber, this was the first of many cartridges that were necked up and down from that basic 7mm Winchester case.

The first rifles chambered for this wildcat could provide better ballistics than the factory 6mm cartridges available at that time. However, the cost in powder usage, and a shorter barrel life was more than the sum gained in velocity. Nevertheless, the 6mm-284 is a fine case to work with. It took considerable testing by the developers of the PPC case to prove, beyond the shadow of a doubt, that a shorter powder column makes for more efficiency in case design. The shorter powder column allowed more uniform ignition, resulting in a very uniform shot-to-shot velocities. This uniformity helped tighten groups. When the obvious advantages of the PPC became known, the benchrest shooters embraced this case and it is still the standard to which all other accuracy cartridges are measured to this day. Before the shorter powder column theory was accepted, the .284 case was already in existence, nearly a half inch shorter than its nearest competitor, the .270 Winchester.

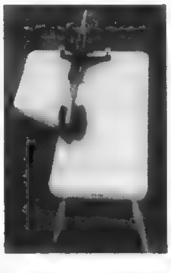
The .284 case is made by only Winchester at this time. That firm's tough brass is known to tolerate higher pressures loadings than several other brands on the market, a plus for reloades. The case has the standard '06 rim size, with a larger body of near magnum sized case proportions. These dimensions are combined with a sharp 35 degree shoulder, and a total case of only 2.17 inches. The case can hold approximately 60 grains of powder, making for a potentially powerful, compact cartridge.

In attempting to push the boundaries of the 6mm cartridge and achieve even better ballistics from this already proficient bullet diameter, I chose two different paths. First, heavier, better designed bullets. Berger Bullets first arrived on the scene with a VLD (very low drag) design. The bullets were extremely long, with a 15 caliber ogive and boattail design; they immediately provided a flatter trajectory with superior wind bucking character istics. These bullets caused cartridges to appear at Long Range rifle matches that were unheard if at hose events. The established excellence of the Thirty caliber bullet at last had some competition! The fact that these bullets could be driven at higher velocities with less recoil was not lost on experienced target shooters.

Recoil is the necessary evil of shooting the high powered rifle. Soon Sierra made available an entire series of VLD bullets including a 107 VLD 6mm design. Since the Sierra jackets are thicker than their competitors, they can be driven at a higher velocity and still hold together. This is an important factor when the barrel twist for theses 6mm bullets is one-in-eight. Thus the bullet can be spinning at over 279,000 R.P.M. at 3,500 fps. velocity.

The rotational component of a bullet's energy in flight is often overlooked by many shooters. While velocity is reduced from the muzzle, the revolution rate is barely reduced from muzzle to target, as proven by Norma many years ago. The most obvious example of the quick-twist high energy phenomenon (and American misinterpretation) starts in Europe. For years the Europeans, with small cased, quick twist cartridges had been dispatching the largest Stags and Nordic Moose with great proficiency. These smaller cases (6.5 Swede, Mannlichers etc.) used 140-160 gr. Bullets and seemed to produce efficiencies all out of proportion to their size.

Winchester noted this phenomenon and applied the simplistic old American idea — BIGGER IS BETTER. Thus the .264 Winchester Magnum was born, a huge case with the same size 6.5 mm bullet. Unfortunately, Winchester opted to used the factory standard for barrel twists at the time (1-in-10) and the cartridge suffered from bullet expansion problems of blowing up at short range and failing to expand at long distances. The .264's problems helped propel the demand for the Remington 7mm Magnum. This 7mm cartridge, in its slicked up Model 700 rifle, provided the impetus to Remington's ascendancy to become the most popular sporting rifle in the U.S. Had Winchester adopted a quick twist barrel for the .264 and spent some time in bullet development so their product would have reliable expansion at the velocities the magnum case provided, the outcome might have been entirely different. It would only be conjecture as to which cartridge would have proven to be the most popular. The point is, a quick twist' bullet's energy is superior to a similar bullet with a slower twist rate at the same velocity.



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The 6mm Sierra VLD bullet is 1.243 long, with an ogive of 15 caliber, and a boattail of 15 degrees. This translates into an excellent design more capable of retaining energy while producing superior windbucking potential. Thus the advantages of using the 6mm for varmint shooting over smaller calibers, is extended even further with this particular bullet.

Some help has been achieved in both the shape and coatings for modern powders lately. Newer powder coatings keep the barrel cleaner longer with reduced fouling and the tubular shapes are being reduced in overall length. Shorter granules allow more uniform powder charges to be thrown from our powder measures. Please note that Alliant RE22 is nearly half the length of 4831, even through their burning rates are quite similar. Still, throat erosion due to high pressure usage seems inevitable, and causes the frustration that the barrel starts losing its excellently "smithed" throat from the first shot fired.

An alternative solution is seen by some. By reducing the load, and watering down the performance, one could extend the bore's life. While this may be the case, ultimately, the premise seems preposterous. If you want to extend the barrel's life simply have it chambered for a smaller cartridge and reap the benefits of longer barrel life. Shooting a rifle chambered for a cartridge capable of a "stretched string" flattened trajectory, as considerably less than what its capable of achieving is akin to entering an Indianapolis race car in an Economy run. In either case, both examples are not being utilized properly!

Cartridges designed for flatter trajectories require higher pressures, usually more powder, and higher ballistic co-efficient bullets to take advantage of the better ballistics. The results of a flatter trajectory are: less room for error in range estimation, less windrift down range, and excellent accuracy with these high quality, superbly designed projectiles. The price a shooter pays when achieving higher velocity with a heavier-than-the norm VLD bullet, is shorter barrel life. I have been told by some gunsmiths that some varmint cartridges currently in vogue have a throat life of less than a thousand rounds. Therefore, anything that could be utilized to extend a barrel's life, with the high velocity loadings, could be appreciated.

Obviously, the quick twist, high velocity cartridge is the classic formula for a quickly worn-out throat if some precautions aren't observed. Conditioning the barrel when first being fired is quite important in that barrel's life. Barrel conditioning for large volume cases for my rifles takes place during the initial visit to the range. A friend of mine introduced me to "T" Lube, a telomer available in a spray can that is used in high pressure, very high temperature situations. "T" lube is made by Certified Laboratories (PO Box 2493, Ft. Worth TX 786113-2493; phone 800-527-9929 TX 800-442-7950) Primarily a release agent, it contains no grease or oil, is non-staining and repels oil, water, and dirt.

Bob Knowles demonstrated the products' usefulness to me when conditioning his new 6PPC barrel. Bob carefully sprayed the "T" lube on his custom made bullets, then fireformed forty cases; running a dry patch through the bore only four times in the sequence. Bob then coated a patch with Sweets and put it in the barrel and left if there for ten minutes. He knew my hair was standing on end leaving in a brand new barrel that long. But after the time was up, he removed the patch. There was absolutely no blue anywhere on that patch! I examined the patch thoroughly and decided to give "T" Lube a try.

The second portion of my attempts to condition this barrel so that its effective life has been lengthened is the CSC treatment from J-Tex technology from Kilgore, Texas. Catalytic Surface Conversion (CSC) developed to reduce surface friction, changes the surface grain structure of the metal and reduces its tendency to gall. J-Tex developed this technology for the "oil patch" industry to extend the life of the drill bits etc. They used the process primarily to reduce the effects of wear and erosion. The chemical immersion doesn't change the

Continued on next page

Barrel Conditioning

Continued

dimensions of the barrel, but does change the surface grain structure and increases the surface resistance to abrasive wear. Thus the barrels are strengthened, the Rockwell hardness increased without altering the inherent properties of the treated base metal. J-Tex asked me to test their process and I am in the process of doing just that. The immediate change on some of the barrels I have had converted is that the barrels foul much less.

The third part of the triad of methods to increase barrel life is "moly" coating the bullets. Molybdenumdisulfide particles are incredibly tiny and pervasive. Recent testing is revealing that bullets "go to sleep" quicker when they are "moly" coated and that barrel life is increased. The bullets, when tumbled properly utilizing the excellent instructions provided by NECO, are actually undergoing a low impact plating process. Rotary vibrators are mandatory for this process, and you must carefully avoid skin contact with this invasive material! Tumbling the bullets with carnuba wax after being moly coated seals the pores and retains an even moly coat on the bullet's surface. Oftentimes when bullets are on the edge of stability and betray oblong shapes in a target, if the barrel is a good one, the bullets may be stabilized by "moly" coating them.

The rifle which I had mounted the new barrel was my switch-barrel heavy varmint rifle. The rifle had been assembled for me before I moved to the coast by Dan Dowling of Palisade, Colorado. I wanted to be able to shoot high intensity cartridges all day long, and utilize the same scope, modified by Premiere to 14 x 36X with a custom reticule, and the same Jewell trigger. The way to do this was with a switchbarrel rifle, so overheating wouldn't become a problem.

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I obtained a used benchrest unlimited stock, had a 2" by 14" custom made steel sleeve made for the Remington action as a Vo-Tech project, and sent off the parts to Mr. Dowling. Dan must have laughed out loud at the incongruous mess he received, but he created exactly what I wished with a pride of craftsmanship that was self evident in the finished product which arrived at my door. I'd recommend Dan to anybody searching for a meticulous gunsmith whose pride of craftsmanship and excellent accuracy producing skills are evident in the rifles he completes. The rifle is massive and stable, and no matter which barrel I have attached to it, is a pleasure to shoot.

The first range session with the VLD 6-284 was held at the Seattle Police Range, right in the city of Seattle, It's neat firing a highpower rifle outdoors at 200 hundred yards, within a few miles of the Space Needle! I wished to thoroughly "wring out" this cartridge, with this barrel and VLD bullets. A 6mm-284, owned twenty six years ago, proved to be a disappointment. A very accurate Sako actioned rifle, I shot it in comparison to my .243 at 200 and 300 yards. No one I had met had even seen a chronograph at that time. However, the resulting impact at 300 yards from a 200 yard zero, left little discernible difference between the two cartridges, despite the usage of 11 more grains of powder in the 6mm-284 case, so little velocity was gained that I ultimately sold the rifle.

I have made a case for my reloading usage at the range which allows me to utilize the standard 7/8-14 dies at the rangesite. The device allows me the same reloading flexibility's as a shooter using his benchrest rifle and the specially designed dies and presses. This reloading box requires less than half a sheet of plywood to construct, and finally allows me to do a much more greater range of testing in a short time when utilizing my standard dies. The box contains an RCBS "Partner" press and a Redding BR3 powder measure. A rabbeted relief into the sidewalls allowed a 5/8" aluminum shelf to be epoxied securely into place. Total weight of the case fully loaded is 26 pounds with press, scale and some components. There is room for ample components. I designed the door to open fully to house some of the reloading tools. When opened, it acts as a wind break. Knowing full well the stresses a bench goes through when reloading with a press, I placed a 1" spacer block under the press for extra stability. This spacer may be overkill, even for full length sizing some rather large volume cases; however I prefer to err on the side of structural stability. Securely clamped to a bench, the unit has proven to be sturdy and reliable, and performs exactly as I'd imagined.

When utilizing the case for loading at the range I've developed a system that seems to work very well for me. After I have assembled everything properly, three cases are loaded with my starting load with a particular powder. I fire these cases over and over and use these criterion's for an evaluation.

1. A chronograph, indispensable, not only for the velocities recorded so that a comparison can be provided as powder is changed; but also for shot-to-shot velocity variations. This velocity variance can show the shooter's need to throw consistent powder charges, and the inherent inconsistencies some powders have. A high velocity load with a powder that provides a high degree of velocity variation (and pressure) may not prove to be the best powder for your use even though the "numbers" look good on the chronograph.

2. The micrometer — use it each time you fire the three cases by measuring the base of the cases, ahead of the extractor groove. The micrometer can give you indisputable evidence that your pressures are increasing, if your "mike" is showing larger numbers every time you reload. Between the "mike's" numbers you can notice case expansion. If the tumbler is moving slightly every time you shoot (in terms of case expansion) you are in high pressure territory. If you are in extremely high pressure territory, slow down and make every decision a well thought out one. Don't try to reach a specific velocity goal, just because somebody told you they were able to get -,000 fps with their rifle. That doesn't mean yours is capable of that same velocity. Variables outweigh simple comparisons, which is why some .280 Remingtons achieve higher velocities than some 7mm magnums. Remember, blowing up a rifle just to reach a specific number on a chronograph doesn't make sense, and each rifle is a definitive, unique rule unto itself.

3. Your groups — If the chronograph is showing a consistent increase in velocity with each powder increase, and your cases aren't expanding too much, look to your group size as your final determination. When your groups start to expand you're loading too hot!

That's the purpose of reloading with the three case limit. In the time it takes to check the cases out properly, clean the barrel, reload the same three cases and return to shooting, your barrel should have cooled. Since you don't build up excessive heat normally by firing three shots, it doesn't take so long to cool, and a steady progression of testing should allow you to thoroughly explore a cartridge's potential. If testing powders, just test powders. Leave all the other components exactly the same. This way an exact comparison can be made that makes for reliable future reference. If you feel the need to change bullets, primers etc., do it after you've conducted the powder tests. This allows a direct apples-to-apples comparison.

As you continue to test and increase your loads a point will be reached when another increase in powder makes little or no gain in velocity. You are past the point of efficiency with that case/powder combination. If the micrometer tells you the cases are expanding more than the norms you have established, you are way past the point of efficiency. I repeat, each rifle is a rule unto itself, velocity without accuracy is worthless, and higher pressures with no velocity increase is insanity.

Ideally, an orderly increase in powder should produce higher velocity. At the point where velocity starts to "stall," group size remains consistent and the "mike" says expansion is consistent with powder increases, is where I stop. I've found that some powders provide more velocity than I thought could be safely reached, resulting in a flatter trajectory. Some powders disappoint, but that's the purpose of testing. I've found that each of my rifles have particular likes and dislikes as to powders, primers, and bullets, that were worth the time taken to discover them. In some cases the final loads were quite similar to reloading manuals, in some cases, definitely not.

Thus I can, with my micrometer's and chronograph's help, test a whole range of powders and bullets in one setting, with the same cases.

This VLD barrel was the first "specific single bullet" barrel I had ever ordered. Therefore the testing could be concentrated. I already had old data from my first 6mm-284 and from reloading manuals. However, there was no data for the 6-284 VLD combination that I had access to. The focus was on slow burning powders which nearly filled the case. I chose 4350, 4831, Alliant RE22, H 1000, and 7828. The last three powders weren't available when I had owned this cartridge previously.

When conditioning this barrel for such a high intensity cartridge, I went to the demanding case of cleaning the barrel after every shot, for the first fourty shots. This way of conditioning may seem extreme and unnecessary, however the quick twist barrels, in order to have a longer lasting life, require extra effort. This method certainly didn't hurt the finely made and "smithed" tube since it was carefully done from first cleaning to last.

4350	**4831**
46.0 gr.-3,191 fps	49.0-3,105 fps
47.5 gr.-3,313 fps	50.2-3,370 fps
48.7 gr.-3,584 fps*	51.7-3,413 fps

7828	**H 1000**	**Alliant RE22**
50.0-3,079 fps	50.0-2,979 fps	51.7-3,540 fps
51.2-3,210 fps	51.3-3,112 fps	52.2-3,557 fps
52.7-3,359 fps	52.7-3,379 fps	52.7-3,590 fps

*too hot

As you can see, Alliant RE22 produced the highest velocity, fine accuracy, and consistent shot-to-shot velocities only exceeded by the ball powders. I was surprised that H 1000 didn't give me higher velocities. While 4350 produces very high velocity, it doesn't come near filling the case without indicating some extremely high pressure. Near 3,600 fps using RE22 with a 107 gr. VLD bullet makes for a powerful, flat shooting, wind resistant combination that proves excellent when pursuing varmints.

Since conducting these velocity tests I have started to moly coat the bullets used in this rifle. Overall, the velocities have dropped approximately 147 fps "across" the board. Most significantly the pressures have plummeted. A comparison between previously fired cases and recently shot ones is dramatic. A fellow shooter commented that my newer cases' primer appear the same as factory fired 30-30 primers do, by comparison. The difference in trajectory at 600 yards is exactly five "clicks" up on the scope compared to a previous zero at that distance. If I want to regain the velocity I could raise the powder charge, but the increase in accuracy and lengthened case life more than offset the small loss in velocity.

I used this load on a Rockchuck hunt with Rich Kayser. The lava rock provides an excellent backdrop to keep these bullets from ricocheting. Thanks to Rich's wind reading ability, range estimates, and his rockchuck spotting, no chuck escaped when this rifle was pointed in their direction that day. The 107 gr. VLD's ability to resist windrift at this high velocity was absolutely excellent on that high, windblown Idaho mountain. The velocity must have been higher than indicated at Seattle's sea level, since the 107 Sierras shot even flatter than the computer generated tables indicated. Apparently, the bullet's ballistic co-efficient may be higher than indicated at this velocity since Sierra's assigned .567 to this bullet at 2,400, not 3,600 fps.

While the velocities gained were more than I had hoped for with 6mm-284, the wear factor should almost start to be gauged from the first round of the tests. I had been told that the throat erosion could be measured from the first hundred rounds fired. When I reached that number I checked the throat with my Sinclair depth seating gauge. Just .004 wear! When doublechecking to be sure, the same figure was reached. I don't pretend to have found a miracle antidote for long life to combat throat erosion. I do believe the "T" lube break-in on moly coated bullets, in a barrel that has been treated with the CSC formula does aid barrel life, and I will use these products from now on in any barrel. You cannot break the immutable laws of physics, however, you can bend 'em just a bit, from time-to-time.

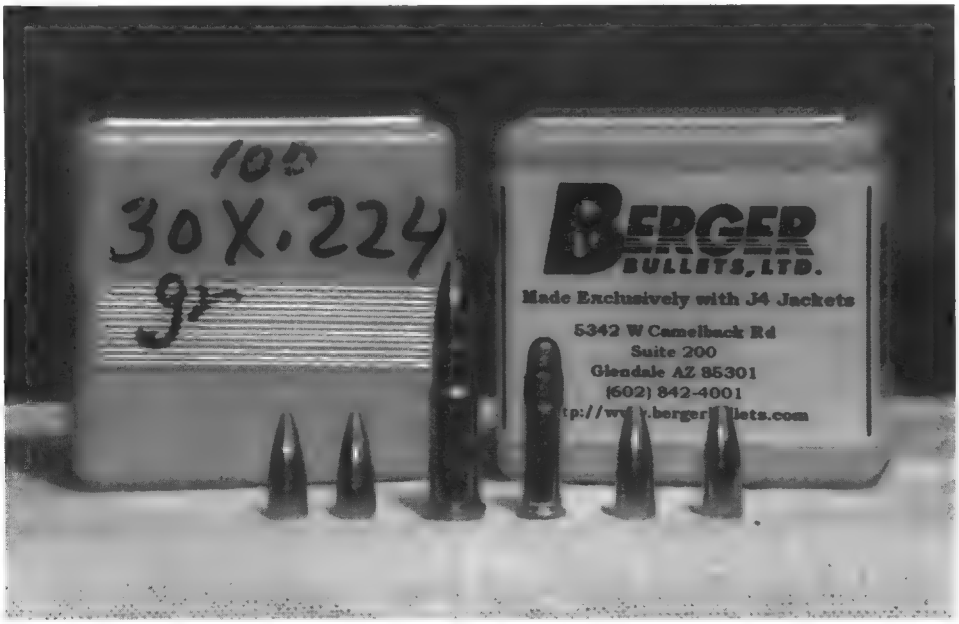
The test I undertook with the 6mm-284 made me glad I had decided to reexamine this wildcat once again. The newer, slower burning powders and excellent VLD bullets revealed a cartridge capable of much greater performance than I had thought possible. There is no perfect cartridge, but the 6mm-284 with VLD bullets is at the very peak of long range varmint cartridges.

NEWS FLASH!!!

Introducing...

The New "22 Squirrel" and Berger's New Lightweight 30 & 35 Grain Twenty-Two Caliber Bullets!

Cascade Alpine Cub in 22 Squirrel



The brand new 30 and 35 grain Berger bullets, a 22 Squirrel and a 22 Rimfire for comparison.

BY TODD A. KINDLER

It's been a long time coming. At least several years back Tom Thomas of The Outdoorsman and I were enjoying a glass of fine wine late into the evening, discussing a very small reloadable cartridge for short range shooting. Both of us seem to get a call or two every couple of weeks from customers looking for a very small reloadable cartridge for hunting tree squirrels, gophers, prairie dogs or just for some real fun shooting out to 100 yards or so. Both of us felt with all the new light .17 caliber Berger Bullets it would need to be a .17 caliber. So one thing led to another and finally a good customer sent me a couple of .17 Squirrel cartridges. The way I understood it a group of local South Dakota ranchers were literally having a ball with it out to about 150 - 200 yards. It was very quiet, extremely fun to shoot and reloadable as well. Kind of like a magnum rimfire plus, so to speak.

(Editor: To make life easier for some of our new readers... the .22 Squirrel is based on a shortened and improved .22 Hornet case. It was designed by *Precision Shooting* columnist Todd Kindler for squirrel hunters, short-range varmint shooters, and casual target shooters who might be looking for the ultimate reloadable small .22 centerfire cartridge. Today, coupled with Berger's brand-new, match grade 30 and 35 grain bullets, the precision handloader can work up loads for specific purposes... whether it is a slightly reduced load for squirrel or turkey shooting, or a full throttle load for woodchucks, crows and prairie dogs. The .22 Squirrel case, and Berger's new, light 30 and 35 grain bullets would seem to be a perfect combination for the sophisticated small game hunter looking for a quiet and safe cartridge for specific applications in the game fields).

So off went a sample .17 Squirrel cartridge to Dan Green of Foregreens, Inc. for a finish reamer and one to RCBS for a custom form die set. Jay in the RCBS custom department has always been a big help to me and really chuckled when he saw the little .17 Squirrel round. In a few weeks the forming dies arrived and I started forming cases. After the first two forming steps, I noticed the formed cases looked to be about .22 caliber. I trimmed a couple and checked inside the neck. It was right at this point in the forming

Loading the 22 Squirrel was quite easy with the Wilson precision hand dies and Berger's new 30 and 35 grain bullets.

operation that the cases were exactly .22 caliber. I called Tom Thomas and asked what he thought of a .22 Squirrel as well. Tom thought it would be a great idea, so the .22 Squirrel was born!

Another finish reamer was ordered from Dan Green of Foregreens and Tom decided to contact Butch at Cascade Arms and see if he could make the small Squirrel cartridge function out of the Cascade rifle magazine. Butch needed some sample Squirrel cartridges, so I sent off a half dozen or so of each. A few weeks later, Tom called and said that Butch had redesigned the magazine to make it work, and he had ordered a half dozen each of the .17 and .22 Squirrel custom rifles. These would be based upon Cascade's smallest action, the little Alpine model and would be a petite sporter rifle for walking and hunting.

In the meantime, I would drive over to Harrisburg, Pennsylvania to join Tom and JoAnn and Dave Brennan in a booth at the Eastern Sportsman Show. My trip through a blinding snowstorm got me into the hotel lobby very late that night, but my ole friend, Tom, was sitting there all alone waiting for me. Dave, on the other hand, was just a tad smarter than me and decided to let Tom, Jo and me hand out *Precision Shooting* flyers that day, and he wisely arrived once the roads were clear. (Editor: Mother raised no complete fools...)

Tom had also invited a special customer who has an obsession with fine classic small caliber rifles made by Kimber, Cascade and Cooper Arms. I would be staying with this gentleman named Howard in the hotel room. Howard was first and foremost a very kind gentleman from South Carolina. Very fun and easy going with a superb knowledge of the small classic cartridges like the .22 Hornet, .22 K Hornet, 218 Bee and rimfires as well. After working the show for almost twelve hours and a fine supper, Howard and I headed to our room for some needed rest. After freshening up, Howard dug out a box full of old classic shooting books. He handed me an old one by Landis on woodchuck hunting. In it was page after page of articles on these old classic small .22 caliber cartridges. I noticed the .22 Hornet, .22 K Hornet and Bee loads listed a 30 and 35 grain bullet weights and asked Howard about these lightweight .22 bullets. Howard said, "Oh yes, they used a lot of light bullets back then, and I would give anything to get my hands on some light match grade .22 bullets".

As soon as I got back home, I called Walt Berger of Berger Bullets, Ltd. and asked if he could make some 30 and 35 grain bullets for the small twenty-two caliber shooters. I explained to Walt what I had seen in those old classic books of Howard's and thought the .22 Hornet and Bee shooters would be in seventh heaven not to mention how these bullets would really get the .22 Squirrel off the ground. Walt said he would really try to help. Months passed and finally Walt called and explained to me how none of the bullet making dies they had would make a very light bullet like that, so they had to order a special die set just for those two bullet weights.

The month of May came and Tom, JoAnn and I were in our tent at The Super Shoot, which we now do every year. Tom as always had a surprise, and this year it was quite special. After we had set up our tables, Tom unzipped a gun case and pulled out the very first .22 Squirrel Cascade Alpine Cub rifle. A classic style rifle in every respect. Butch at Cascade and Tom did just a wonderful job designing this first prototype rifle. It's petite classic style is first and foremost for hunting. As I mentioned earlier this is Cascade's smallest action. The Mauser style action is $7^1/2$ inches long with a "controlled feed" three shot magazine. It is handsomely engraved with *Cascade* and a mountain scene on the center left side with the engraved letters Alpine Cub on the left front side. A very nice touch that I wish more rifle manufacturers would employ. The small Mauser style bolt is machine turned and the bolt handle is nicely checkered on all four sides. A lightweight 20 inch long barrel with *.22 Squirrel* engraved on the left side is machined and crowned beautifully. Both the action and barrel are richly finished and blued to a soft satin luster. A very nice bolt release is on the left side and is checkered as well. Underneath is worth a look at the small floorplate/trigger guard assembly, which is finished to match the barrel and action. As I looked underneath, I noticed the inletted sling swivel studs and steel pistol grip cap. Every screw on the floorplate, grip cap and swivel studs are "in line" (or pointing in the same direction), something we should expect on top custom grade guns.

Now we can discuss the wood, which is my favorite part of a rifle to review. This petite Claro walnut stock is classic style all the way. It features a small cheekpiece and a Schnabel style forend. A beautiful satin stock finish and hand checkered pistol grip and forend add a lot to the rifle's appearance. A Niedner style checkered steel butt plate with the screws in line grace the end of the rifle. In a nutshell, it is just plain handsome, but how would our very first .22 Squirrel perform?

Continued on next page

News Flash!!!
Continued

It was all coming together at once. We had the very first .22 Squirrel rifle, and Jon Morrison, President of Wilson Tools & Gages was kind enough to supply a set of precision hand dies to get us loading. (Hopefully we can convince Jon to make a run of the .17 and .22 Squirrel precision hand dies to go with the Cascade rifles!) Tom had also sent over a new Weaver 2.5-7 power rimfire scope and a set of Warne rings to get me going.

After forming a handful of the small .22 Squirrel cases, I started sorting through my powder supply. This little cartridge would need a fast powder so I picked Hodgdon 110, Hercules 2400, Vihtavuori 110 and Accurate Arms 1680 to test. I selected Remington $6^1/2$ small rifle primers for the testing as they have always worked well for me in small cases before. When I started testing the lightest bullet I had was Berger's 40 grain M.E.F. (Maximum Expansion Factor). I set my target up at 50 yards for initial testing, as this rifle would basically be used for tree squirrels and varmints between point blank range to 100 yards. However, after testing I'm now convinced it could be tough on crows, gophers and prairie dogs out to about 200 yards!

First to test was AA1680 and 40 grain Berger M.E.F. bullets with very good accuracy and velocity between 1600 and 1921 f.p.s.; not too bad for a case only .978 long with a 40 grain bullet. Next was Hodgdon 110 with velocity between 1591 and 2380 f.p.s. Accuracy was outstanding with many loads and the 40 grain Berger bullets. Then on to Vihtavuori 110 with velocity from 968 f.p.s. through 2095 f.p.s. My shooting notes say very accurate with 6.5 grains of Vihtavuori 110. The last powder to try with the 40 grain Berger M.E.F. was Hercules 2400, with velocity between 1634 and 2075 f.p.s. All four of these powders provided excellent accuracy from light to almost full loads. The upper end loads required dumping the powder very slowly form the measure. I do not like to compress powder charges too much, so dump your measure slowly, use a long drop tube or both.

At 50 yards some very small groups were shot with all of the powders and the 40 grain Berger was really performing well. For long range varmint shooting, I would go with the Hodgdon 110 at over 2400 f.p.s. For squirrel hunting in the woods (or timber, as they say in Iowa) the Vihtavuori 110 or AA1680 would be hard to beat. The Weaver $2^1/2$ - 7 power rimfire scope was crystal clear and adjustments were on the money. For close range to 50 yards it is a fine scope indeed. However, when I moved the targets to 100 yards, it was very blurry with it's parallax permanently set at 50 yards. I did manage to shoot a couple of 1 inch five-shot groups with it even though it was so blurry. Next, I moved the targets to 75 yards and it was still somewhat blurry. Like I said, the Weaver scope is so clear at 50 yards and beautifully matte finished with gold lettering, it is a shame the parallax cannot be adjusted to 75 and 100 yards. It is such a nice scope, I would love to see them add a very small parallax adjustment system up front to compensate for the longer ranges.

I really wanted to test the .22 Squirrel at 100 yards, so I asked Tom to send another scope. This time he sent a Burris 4 to 12 power Compact scope with a complete parallax adjustment on the end. I shot quite a few 100 yard groups that seemed to average between $^5/8$ and $^3/4$ inch but a few had a single flyer out to about 1 inch. Remember this is a very light sporter rifle, and I did not adjust the

Right side view of Cascade's Alpine Cub. Notice the machine turned bolt and checkered bolt knob.

Niedner style buttplate with both screws "in time" graces the Cascade Alpine Cub.

four pound factory trigger pull although the Cascade trigger can be easily adjusted to about a two pound pull. I wanted to test this .22 Squirrel Cascade rifle literally right out of the box with no adjustments. I know those 100 yard groups in particular would shrink a little with a lighter trigger pull. All in all, I'm convinced the .22 Squirrel in an accurate hunting rifle like the Cascade could average somewhere between 1/2 and 3/4 inches at 100 yards. At 50 to 75 yards it is a barn burner to say the least, and our large Fox squirrels would be in extreme danger at those ranges with this Cascade rifle.

Walt Berger recently called and said he had shipped the new light weight 30 and 35 grain .22 caliber bullets but this was on the day after UPS went out on strike. Just my luck! A few days later a UPS truck came up the driveway and a short, thin man brought the box of bullets to my door. I said something to him to the effect that I thought UPS was on strike. He responded that he was management. He seemed quite nervous talking to me and went on to tell me that two car loads of union drivers had just pulled up my driveway behind him. Just then my phone rang. As I was trying to think what I should do, I watched out the window as he drove his truck down the dusty township road with the two cars in hot pursuit (not a good situation!). Well, at least I now had the new bullets to test.

Inside the cardboard box were the very first boxes of Berger 30 and 35 grain match .22 caliber bullets made. I quickly opened them and was very surprised at the small jewels inside. What neat looking bullets! The 30 grain were match style with a small hollow point, and the 35 grain were large hollow point M.E.F. style. Walt told me he plans on a 30 grain M.E.F. later and possibly some minor changes in design as well. These were definitely "prototype", as one box was even hand labeled, but by the time you read this, full production may be close or on the way. This is very exciting news not only for the .22 Squirrel, but for Hornet, Bee and small .22 caliber fans

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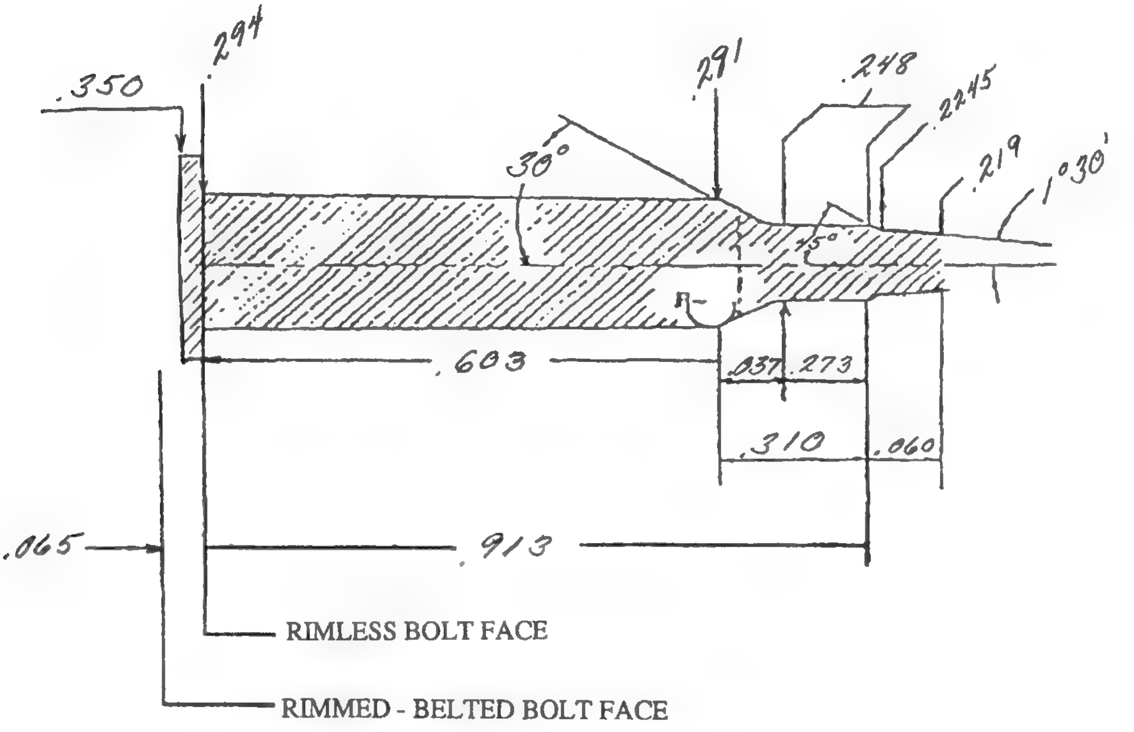
MINIMUM CHAMBER DIMENSIONS FOR THE 22 Squirrel
for Todd A. Kindler



D - D = .003

Rim diameter
Diam. @ shld.
Throating: 1°30' is .105 long
and with this seating there will
be bullet jump.

BORE .224
GR. DIA. .219
BODY ITPI .00497
NECK ITPI NONE
BRASS 22 Hornet
FREEBORE NONE
DATE 6-1-96
CUSTOMER T. Kindler

News Flash!!!

Continued

around the world. I really believe in light bullets moving fast and this may just be the ticket in these old and new classic cartridges.

Back to the loading bench to test those light 30 and 35 grain bullets. Basically the same powders were tried as with the 40 grain bullets, plus the addition of Hercules Unique. Velocity was just slightly higher with most of the powders. Hercules Unique was tested all the way from 677 through 2463 f.p.s. with good results. It may be my choice for reduced squirrel and turkey hunting loads between 1500 and 2000 f.p.s. with 30 grain match style bullets. The match style bullet may show less destruction on small edible game.

The 30 and 35 grain bullets, like their heavier 40 grain cousin, shot super at 50, 75 and 100 yards. I was hoping for just a little more velocity gain with them over the 40 grain, however, their accuracy level was no disappointment. I realize now the .22 Squirrel is so efficient that velocity levels show only a modest gain with the new light bullets. The .22 Hornet, 218 Bee and other small .22 caliber cartridges may well show a substantial velocity gain with the new light bullets.

Recoil in the little Squirrel was almost nil with the new 30 and 35 grain bullets. This is another advantage to moving light bullets fast. A Thompson Center Contender handgun in a .22 Squirrel, .22 Hornet, or K Hornet moving the new 30 grain Berger bullets may be a lot of fun to shoot and varmint hunt with.

I know there are many .22 Hornet, K Hornet, 218 Bee and 218 Mashburn Bee shooters out there who will want to dust off their old rifles, dig out their reloading equipment and try a few of these new fast moving lightweight Berger bullets. Think of all the "light beers" not to mention all the "light" food that my daughter says is better for me. Now we have "light Berger bullets" and a dandy "light rifle" to shoot them in with Cascade's New Alpine 22 Squirrel! **(Coming Soon, Part II - The .17 Squirrel!!!)**

LOAD DATA FOR 22 SQUIRREL

Rifle: Cascade Alpine Cub
Barrel Length: 20"
Case: Reformed .22 Hornet
Scope: Weaver 2.5-7 Rimfire & Burris 4-12 Compact
Primer: Remington 6½
Temperature: 80 degrees, humid partly sunny
Range: 50, 75, 100 yards
Reloading Dies: Custom Wilson

HODGDON 110

6.7 grain H110	30 grain Berger	2195 f.p.s.	
7.7 grain H110	30 grain Berger	2420 f.p.s.	almost full dump slowly, varmint load
7.7 grain H110	35 grain Berger	2401 f.p.s.	almost full dump slowly, varmint load
5 grain	40 grain Berger	1591 f.p.s.	squirrel load
6 grain	40 grain Berger	1857 f.p.s.	squirrel load
6½ grain H110	40 grain Berger	1943 f.p.s.	
7 grain H110	40 grain Berger	2118 f.p.s.	
7½ grain H110	40 grain Berger	2295 f.p.s.	almost full dump slowly, varmint load
7.7 grain H110	40 grain Berger	2380 f.p.s.	almost full dump slowly, varmint load

ACCURATE ARMS 1680

7.8 grain AA1680	30 grain Berger	1815 f.p.s.	squirrel load
8.2 grain AA1680	30 grain Berger	1886 f.p.s.	dump slowly
7.5 grain AA1680	40 grain Berger	1647 f.p.s.	squirrel load
8 grain AA1680	40 grain Berger	1869 f.p.s.	dump slowly

VIHTAVUORI 110

5.5 grain V110	40 grain Berger	1737 f.p.s.	
6.5 grain V110	40 grain Berger	1964 f.p.s.	
7 grain V110	40 grain Berger	2095 f.p.s.	dump slowly, very accurate

HERCULES 2400

6 grain 2400	40 grain Berger	1634 f.p.s.	squirrel load
7 grain 2400	40 grain Berger	1969 f.p.s.	varmint load

UNIQUE

2.3 grain Unique	30 grain Berger	1617 f.p.s.	squirrel load, very accurate
3.1 grain Unique	30 grain Berger	1991 f.p.s.	
4 grain Unique	30 grain Berger	2258 f.p.s.	
4.5 grain Unique	30 grain Berger	2463 f.p.s.	dump slowly, varmint load

These loads showed no excessive pressure in this particular Cascade Alpine Cub rifle. Many of the loads would practically fill the case dumping powder slowly or using an extended drop tube may help to get additional powder in the small Squirrel case. There may be a half dozen or more fast burning powders that would work very well in this superb little cartridge. The author would be glad to hear from shooters developing safe and accurate loads. Use extreme caution. Reduce all the loads listed and work your loads very slowly and carefully. The author and *Precision Shooting Magazine* assume no responsibility for these loads in other rifles.

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Each Brand And Type Of Primer Has A Unique ENERGY: Which is, Perhaps, the Critical Accuracy Issue

The basic test vehicle, customized Ruger Blackhawk in 45 Colt.

Synopsis:

Having studied various primers, regarding visual appearance of the blast and ballistic consequences of substitutions, I set out to measure the blast energy (as opposed to heat energy) produced by the various large pistol and rifle primers now commonly available. The results of this simple test, which measured how far each type of primer would move a bullet into a bore, are surprisingly informative.

BY M.L. MCPHERSON

In previous studies, I have tested ballistic effects of primer substitutions, which are surprisingly large. For example, substitution between brands of standard large rifle primers accounted for peak pressure variations exceeding 14% in a common 30-06 loading (57 grains of 4350 with a 168 grain bullet). In related tests, I showed that more powerful primers always result in reduced velocity in revolver loads. This latter fact essentially proves that the primer's blast starts the bullet moving before powder ignition occurs.

Related studies of powder position effect (situations where less than 100% of the available capacity is occupied by powder), demonstrated surprising velocity variations. I have concocted one revolver loading where the powder uses about 50% of the available space. That load generates a perfectly normal 850 fps when I hold the gun level and fire normally; with the powder against the bullet, velocity is about 200 fps; with the powder against the primer, velocity exceeds 1000 fps.

Rifle loads are not immune to powder position effects — if the powder does not occupy 100% of the usable space, powder position will almost certainly have a ballistic consequence. More important that this fact is the reason behind this well-established powder position effect: primers move bullets before powder ignition occurs! This explains why bench rest shooters almost always seat bullets into the rifling (which essentially eliminates pre-ignition bullet movement). Since the amount of bullet movement resulting from the primer's blast is variable, loads with reduced bullet-to-rifling jump, milder primers and tighter case necks usually exhibit improved velocity consistency and accuracy.

So, the question is, how to measure primer energy. . . I will return to this. First, I should refer to a study I did comparing visual appearances of primer blasts. In that study, photographs of primer blasts in a dark room demonstrated huge variations in volume, color and character of the resulting incandescent fireball. However, since primer manufacturers utilize various formulations containing various ratios of explosives, oxidizers, fuels and incandescent particulates, it is impossible to ascertain anything about a primer's ignition characteristics or "power," based upon the blast's visual appearance.

Recently, in one of those things that happens to tired handloaders, I managed to inadvertently load a revolver cartridge *sans* powder. The result of popping that cap lead to the study reported in this piece. When I found that Federal's Gold Match 150M (large pistol) primer had driven a 255 grain swaged lead bullet several inches into the barrel, it occurred to me that this might be a good method of measuring primer energy.

I was concerned that other variables could overshadow differences in primer blasts. As the included data clearly demonstrates, that concern was ill-founded.

Continued on next page

Each Brand and Type ...

Continued

I prepared six (6) once-fired, nickel plated R-P brand 45 Colt cases in the following manner: cases cleaned, flash holes deburred (*K&M* tool), inside mouths chamfered (*Wilson* tool), primer pockets squared (*RCBS* tool). The cases, which I had fired with a load of *GOEX* FFg were not resized. I seated all test primers using *Lee's Auto-Prime* tool. I used *Hornady's* extremely consistent, swaged lead, 255 grain 45 Colt, Cowboy Action bullets.

With the slight residual crimp on the case mouth I found I could finger seat bullets. When the case mouth reached the crimping grove the bullet would snap in place at a consistent overall length. I removed the grips from a 7-$^{1}/_{2}$" barreled Ruger 45 Colt revolver. I vised the revolver in padded jaws with the barrel pointed vertically. I placed a board above the barrel to protect the ceiling from potential projectile bullets. (A preliminary study with a tighter 4" custom Ruger proved the value of this decision, CCI 300 primers easily popped bullets from the barrel hard enough to significantly dent the hardwood barrier!)

I then cut a barrel-fitting hardwood dowel to proper length so that when one end rested on a bullet nose in the firing chamber its other end was flush with the muzzle. This measuring gauge immensely simplified my data recording efforts.

After fouling cases, chambers and the barrel by repeatedly firing powderless loads until the data settled down, I proceeded with the test. I decapped the cases using Lee's hand decapper tool and cleaned primer pockets of excess residue before seating new primers. I did no other case or gun cleaning during the test. I did mark the cases and chambers so I could use each case in the same chamber and so I could use the chambers in the same order for each series. This precaution proved useless; there was statistically no difference in results from any case or any chamber.

Testing was simple: chamber a powderless round, rotate the cylinder to bring that round to the next-in-line position, cock hammer, pull trigger. Measurement was equally simple: insert hardwood dowel in barrel, measure length of dowel protruding from muzzle (I used a dial caliper).

I then cocked the hammer and drove the bullet into the empty chamber. I then removed that case and bullet, rotated the cylinder to line up the proper chamber, loaded that with the next *faux* cartridge and repeated the test. I tested each pistol primer type with six (6) "shots".

After completing the pistol primer test, I deepened the primer pockets in three cases to accommodate the taller rifle primers. I then repeated the test using each type of rifle primer with three test shots for each. Why only three shots you might ask: because there was simply no evidence from the pistol primer study to suggest that more than three shots would be helpful in gathering meaningful data. The rifle primer study gave similarly solid results. See explanative comment in the associated box text.

There were clear and evident differences in primer brands and types. These results generally correlated with my expectations. Primer types that I believe are the most powerful, based upon results with normal rifle and revolver loads, generally drove the bullets farthest into the barrel.

I should note that there is an obvious correlation between how far into the barrel a primer drives the bullet and how fast the bullet moves from the case as a result of the primer's blast — the faster the bullet moves, the farther it moves. Excepting the more technical hypothetical discussion in the associated box text, I will make no effort to quantify this correlation, entirely too many problems. First, rifling engraving, which takes considerable energy,

This dowel is resting on top of a bullet in the bore, where the primer's energy left it. The length of dowel protruding from the bore represents the distance the bullet moved.

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dramatically slows the bullet. Second, bullet-to-bore friction is greater than bullet-to-case-mouth friction, which is greater than bullet-to-cylinder-throat friction. However, fortunately, exactly what the complicated correlation between initial bullet velocity and distance traveled might be is unimportant. All that matters is this: a bullet that moves farther into the bore was moving faster as it left the case and (in a normal load) it will have moved farther before powder ignition occurred! That is all we are concerned with.

There is a caveat, however. We cannot prove that powder ignition delay is independent of primer type. A hotter primer might move the bullet faster but might also cause powder ignition to occur so much sooner that the bullet had moved less distance. I am satisfied that this latter possibility is most unlikely; nevertheless, it is a possibility.

Significantly, we are also rescued from this quandary, all that matters is how consistent the bullet's pre-powder-ignition movement is! If each bullet were in exactly the same place in the bore and traveling at exactly the same velocity when pressure from the burning powder came on strong enough to start accelerating the bullet, the load would be consistent. I am confident that the best way to insure such consistency is to have the bullet move the least distance — again, that is why the most accurate loads usually leave the bullet as close to the rifling as feasible. It is also why the mildest primers that can reliably ignite the powder are always the best choice — a fact known to ballisticians since the 1920s, or earlier.

With all that said, here is that data:

Primer Make & Number	Average distance (inches)	Standard Deviation (inches)	Primer Lot Number
CCI 300	1.032	0.046	H18Z
CCI 350	1.379	0.116	K11W
Fed-150	0.932	0.037	2BY093
Fed-GM150M	1.048	0.088	2BY323
Fed-155	1.017	0.057	2CH117
Rem-2-1/2	1.091	0.050	406
Win-WLP	0.970	0.046	HHL399G
CCI 200	1.095	0.119	G25A
CCI BR2	1.155	0.133	D13A
CCI 250	1.287	0.132	K13Z
Fed-210	1.525	0.013	2BY241
Fed-210M	1.324	0.159	2CY117
Fed-215	1.431	0.164	2BH271
Rem-9-1/2	1.430	0.129	849
Rem-9-1/2M	1.480	0.056	2376
RWS 5341	1.071	0.024	- - -
Win-WLR	1.318	0.063	HHL228G
Win-WLRM	1.830	0.145	HLM093G

Note the startling consistency and mild nature of the RWS 5341 primer. No wonder folks such as Randolph Constantine have found this number to be a stellar performer in loads for NRA Highpower competition.

I attempted to also study small diameter primers, using shortened 454 Casull cases (which use small rifle primers) in the same set-up. Unfortunately, those primers lacked sufficient energy to drive these bullets past the forcing cone. I could not find a combination that worked satisfactorily. I suspect a test using a long-barreled 38 Special revolver is in order. Meanwhile, I would guess that, generally, results with large primers would reflect the comparative performance characteristics of small primers of the same make and nominal type.

Concerning the rifle primer results, which were generally more variable than the pistol primer results. I attribute this to two separate causes. First, the relatively feeble hammer strike of this revolver — likely, a more robust hammer fall would have resulted in more consistent ignition with these harder-cupped rifle primers.

Second, and more importantly, the nature of the test system automatically magnifies primer-to-primer energy variations in proportion to the basic difference in primer energy — a primer type that imparts 10% more initial energy to the bullet will very likely drive that bullet more than 10% further through the rifled bore. The reason for this relates to the fact that each bullet is slowed dramatically during the rifling engraving stage of its flight. Engravement takes essentially the same energy from each bullet. Since most bullets traveled only a short distance after achieving full engravement, we can assume that engravement takes almost all the available energy.

Once the bullet has fully engraved into the rifling, frictional resistance is dramatically reduced, becoming essentially constant. Therefore, once the bullet has cleared the throat, a slight increase in remaining velocity will result in a large increase in barrel travel distance. As noted, all bullets tested were fully engraved into the rifling but with the milder primers the bullets had just barely reached that point — those had scant residual velocity and, therefore, traveled only a short distance into the barrel.

Now, assume two types of primers, Brand A and Brand B. Each brand has a maximum primer-to-primer energy variation of exactly 5%. However, Brand B is more powerful and imparts an average of 10% more initial energy to the bullets. We

Continued on next page

Each Brand and Type ...

Continued

will assign an average energy of 100 units, 97.5 to 102.5 units, of energy to bullets launched with primer brand A; for Brand B the numbers are 110 units, 107.5 to 112.5 units.

Now assume rifling engravement takes 95 units of energy. This means that bullets launched with Brand A primers enter the rifling carrying 2.5 to 7.5 units of energy; bullets launched with Brand B primers enter the rifling carrying 12.5 to 17.5 units of energy. If the bore's dynamic friction is essentially constant (a fair approximation) bullets launched with brand B will travel between a maximum of 5.00 times as far (12.5/2.5) and a minimum of 2.333 times as far (17.5/7.5) through the rifling, compared to those launched by Brand A.

Specifically, if Brand A-launched bullets move 2.3 to 5 inches — a difference of 2.7 inches, Brand B-launched bullets would move between 12.5 and 17.5 inches — a difference of 5.0 inches. Brand B primers would, therefore, appear to have more primer-to-primer energy variation. This is an artifact of the test system.

I am confident that this explains why the more powerful primers tested appeared to have more variation. Since we cannot quantify this test system, we simply have to ignore the absolute variation numbers where the primer types impart significantly different energy to the bullet. We can, however, assume that differences in deviations among similar-strength primers are meaningful.

Similarly, and for the same reasons, this test system likely magnifies actual differences in imparted energy. The hottest primers would appear to impart almost twice the energy of the mildest primers, likely the actual difference is somewhat less.

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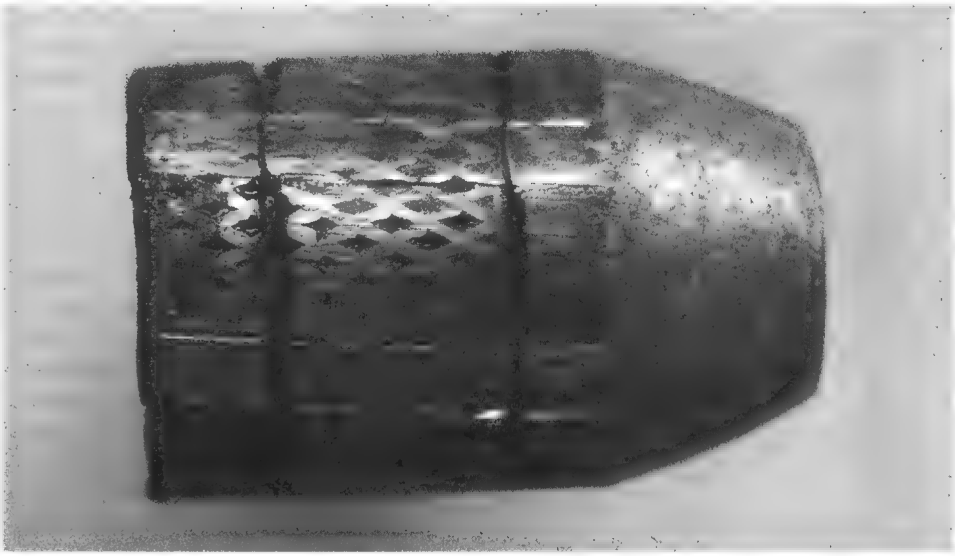
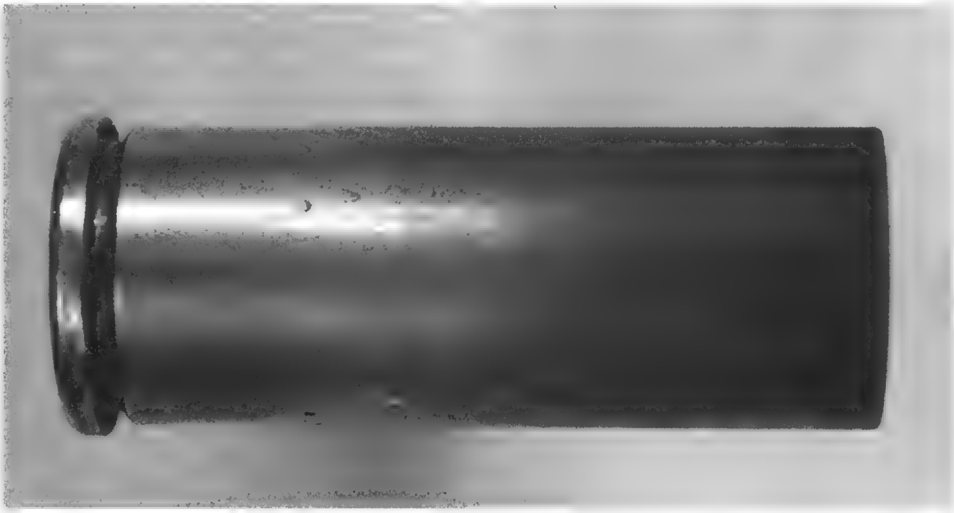
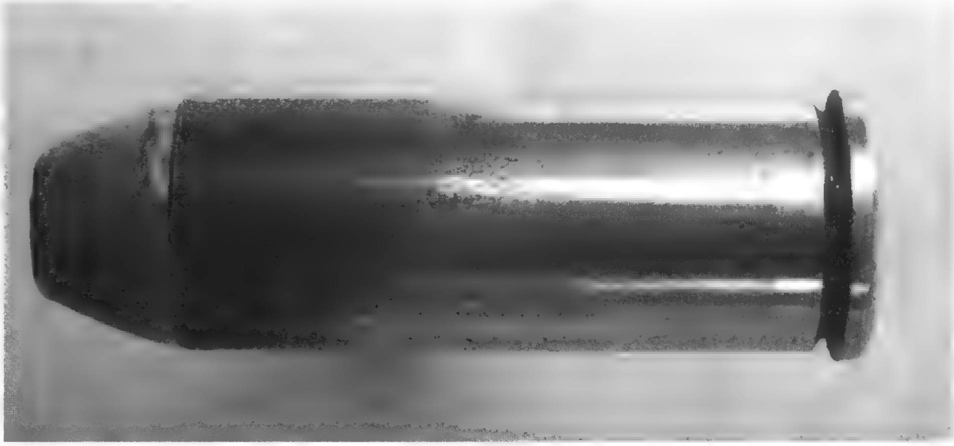


Typical recovered bullet. Note well engraved rifling, smeared tops on the embossed pattern, primer residue on portion of base band (next to base.)



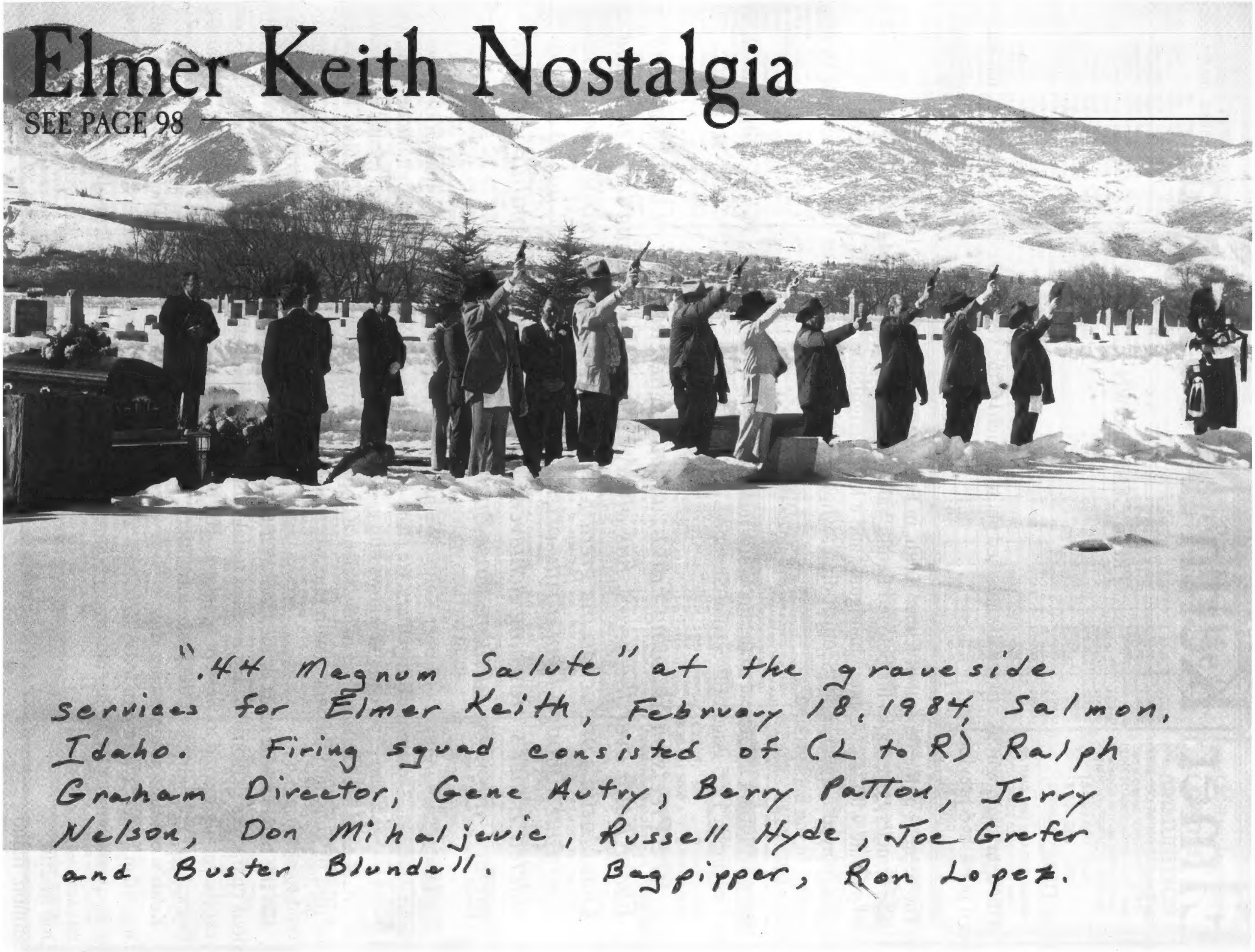
This nickel-plated R-P case clearly demonstrates just how dirty primers are! This residue is bonded to the case.



Example primer powered cartridge: 45 Colt, R-P nickeled case, Hornady 255 grain swaged lead bullet, test primer, no powder.

Elmer Keith Nostalgia

SEE PAGE 98



".44 Magnum Salute" at the graveside services for Elmer Keith, February 18, 1984, Salmon, Idaho. Firing squad consisted of (L to R) Ralph Graham Director, Gene Autry, Barry Patton, Jerry Nelson, Don Mihaljevic, Russell Hyde, Joe Grefer and Buster Blundell. Bagpipper, Ron Lopez.

Continued on next page

Elmer Keith Nostalgia

Continued

FROM GENE BROWN

Dear Dave,

I thought you might like to see the attached photo, which, to the very best of my knowledge, has never been published previously.

The scene is at the funeral of Elmer Keith, in February, 1984, at Salmon, Idaho.
The cemetery overlooks his beloved Lemhi Valley. An honor guard of old friends fired a salute with .44 Magnum handguns, and a kilted Highlander bagpiper , clad in tartan regalia, played a melancholy Scottish dirge, whose echoes were returned by the Continental Divide, towering in the background..

If I may, I think I'll retreat to the quotation that you selected for "The Last Post" for Elmer Keith, in the December, 1995 issue of Precision Shooting....

> *The Precision Shooting Editor, an unabashed admirer of the writings of Elmer Keith over the years, has always found the opening lines of Judge Don Martin's preface to the great Keith book "Sixguns" particularly moving. And although I am a rifle-oriented person, "Sixguns" has to be considered Elmer's crowning achievement. For those not familiar with that preface, allow me to share those opening lines with you...*

I am prejudiced in favor of Elmer Keith. We have been friends for more than a quarter of a century. We have traveled rough trails together. We share a post-dated, old West type of tough mindedness. As a friend and as a gun expert no one knows him as well as I do. Keith has exceptional mental equipment. He would have been outstanding in any science or profession upon which he had no choice. He brought the idea of guns into the world with him when he was born. Guns have been his obsession since he could toddle.

His life began in the heart of the Civil War Guerrilla country. His father and uncles knew the notorious characters personally. He listened to tales of the old gun battles in his cradle. During his sixth year the family moved to western Montana. His boyhood mentors were the Indian fighters, Vigilantes, lawmen and gunfighters of the passing frontier.

Keith's old-time teachers are dust. Their deeds are history and legend. Their philosophies and Draconian codes live in him today. He uses a typewriter, drives a car and prefers to travel by air, but he is, anachronistically, in his innermost being, a part of the decade Charley Russell painted.

Don Martin
Salmon, Idaho

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BULK PISTOL CASES

Caliber	Type	Per 100	Per 250	Per 500	Per 1000
380 ACP	PRIMED	15.00	32.00	55.00	102.00
9MM	UNprimed	14.00	24.00	45.00	78.00
9MM	PRIMED	14.00	26.00	48.00	88.00
10MM	UNprimed	18.00	39.00	69.00	130.00
10MM	PRIMED	19.00	42.00	76.00	144.00
38 SPEC	UNprimed	13.00	28.00	47.00	85.00
38 SPEC	PRIMED	15.00	31.00	54.00	99.00
357 MAG	UNprimed	14.00	29.00	51.00	94.00
357 MAG	PRIMED	15.00	33.00	58.00	107.00
38 super+P	Unprimed	13.00	28.00	48.00	88.00
38 super+P	PRIMED	15.00	32.00	55.00	102.00
40 S&W	UNprimed	17.00	38.00	67.00	126.00
40 S &W	PRIMED	18.00	41.00	74.00	140.00
41 MAG	PRIMED	18.00	40.00	72.00	135.00
44 MAG	UNprimed	17.00	37.00	65.00	122.00
44 MAG	PRIMED	18.00	40.00	72.00	135.00
44 SPEC	PRIMED	18.00	40.00	72.00	135.00
45 L. Colt	PRIMED	19.00	42.00	75.00	142.00
45 ACP	UNprimed	16.00	35.00	62.00	115.00
45 ACP	PRIMED	19.00	39.00	69.00	129.00

WINCHESTER Remington

BULK UNPRIMED RIFLE CASES

Caliber	Type	Per 100	Per 250	Per 500	Per 1000
220 SWIFT	UNprimed	26.00	59.00	110.00	210.00
22 HORNET	UNprimed	15.00	33.00	59.00	109.00
222 REM	UNprimed	18.00	39.00	70.00	131.00
223 REM	UNprimed	17.00	38.00	68.00	128.00
223 REM	PRIMED	19.00	42.00	75.00	141.00
22-250 REM	UNprimed	23.00	51.00	94.00	180.00
6MM REM	UNprimed	24.00	54.00	99.00	190.00
243 WIN	UNprimed	24.00	54.00	99.00	190.00
25-06 REM	UNprimed	28.00	64.00	120.00	232.00
25-35 WIN	UNprimed	23.00	52.00	95.00	181.00
264 WIN MAG	UNprimed	33.00	79.00	149.00	290.00
270 WIN	UNprimed	24.00	54.00	100.00	193.00
280 Rem	UNprimed	27.00	62.00	115.00	220.00
284 win	UNprimed	32.00	75.00	141.00	274.00
7mm Rem Mag	UNprimed	32.00	75.00	142.00	277.00
7mm Mauser	UNprimed	28.00	64.00	120.00	232.00
308 WIN	PRIMED	26.00	59.00	110.00	212.00
300 WIN MAG	UNprimed	33.00	78.00	148.00	288.00
30-06 SPRG	UNprimed	24.00	56.00	102.00	197.00
303 BRITISH	UNprimed	24.00	56.00	104.00	200.00
8mm Mauser	UNprimed	27.00	63.00	118.00.	227.00
338 Win Mag	UNprimed	33.00	79.00	149.00	290.00
348 WIN	UNprimed	45.00	107.00	205.00	403.00
35 REM	UNprimed	27.00	63.00	118.00	227.00
375 H&H	UNprimed	38.00	91.00	174.00	339.00
38-40 WIN	UNprimed	23.00	53.00	97.00	185.00
38-55 WIN	UNprimed	28.00	64.00	119.00	230.00
45-70 GOVT	UNprimed	36.00	84.00	160.00	311.00

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32 Cal 71gr FMJ	28.00	49.00	96.00	273 / 5920
380 ACP 95gr FMJ	28.00	49.00	96.00	205 / 4430
9MM 115gr FMJ hb	26.00	45.00	88.00	161 / 3660
9MM 115gr FMJ fb	26.00	46.00	90.00	164 / 3660
9MM 115gr J.H.P.	27.00	49.00	96.00	185 / 3660
9MM 124gr FMJ fb	28.00	51.00	100.00	165 / 3390
9MM 147gr TC	34.00	60.00	118.00	168 / 2850
9MM 147gr JHP	34.00	60.00	118.00	168 / 2850
38 Sup. 130gr RN	33.00	58.00	114.00	180 / 3240
38-357 110gf JHP	29.00	52.00	102.00	191 / 3820
38-357 125gr JHP	29.00	52.00	102.00	167 / 3360
38-357 158gr JHP	34.00	60.00	118.00	155 / 2660
40S&W 180gr FMJ	49.00	90.00	178.00	207 / 2340
40S&W 155gr TC	48.00	88.00	174.00	234 / 2700
40S&W 180gr JHP	49.00	90.00	178.00	207 / 2340
45 ACP 185gr SWC	49.00	90.00	178.00	202 / 2280
45 ACP 230gr JHP	56.00	104.00	- - -	186 / 1830
45 ACP 230gr RN	46.00	86.00	- - -	154 / 1830

WINCHESTER

BULK RIFLE BULLETS

Description	Per 500	Per 1000	Per 2000	Per CASE
22 CAL 45 GR SP	36.00	63.00	124.00	525 / 9340
22 CAL 46 GR HP	36.00	63.00	124.00	520 / 9140
22 Cal 55gr FMJBT	21.00	37.00	72..00	255 / 7640
22 Cal 50gr PSP	29.00	53.00	103.00	390 / 8400
22 Cal 55gr PSP	29.00	52.00	102.00	345 / 7640
22 CAL 64 GR PSP	37.00	66.00	130.00	410 / 6560
243 Cal100gr PP	40.00	72.00	142.00	294 / 4200
243 Cal 80gr PP	38.00	68.00	134.00	340 / 5250
270 Cal 130gr PP	46.00	86.00	170.00	270 / 3240
270 Cal 150gr SP	49.00	90.00	178.00	246 / 2800
7mm(284) 150grPP	45.00	88.00	174.00	240 / 2800
30 Cal 110gr FMJ	34.00	60.00	118.00	221 / 3820
30 Cal 147gr fmjbt	45.00	88.00	174.00	240 / 2860
30-30 150gr PPw/c	45.00	88.00	174.00	240 / 2800
30-06 180gr SPw/c	52.00	96.00	190.00	220 / 2340
308 150gr PP w/c	45.00	88.00	174.00	240 / 2800
44 Cal 200gr SP	53.00	98.00	--------	204 / 2100

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IMI3006	.30-06 Sprg	$22.00	$ 45.00	$ 87.00	$ 162.00	$ 320.00
IMI76239	7.62 X 39		$ 40.00	$ 60.00	$ 125.00	
UNPRIMED PISTOL BRASS						
IMI9MM	9MM	$15.00	$22.00	$38.00	$69.00	$137.00
IMI38SP	38SPEC	$15.00	$22.00	$38.00	$69.00	$137.00
IMI357MAG	357MAG	$15.00	$24.00	$43.00	$79.00	$157.00
IMI40S&W	40S&W	$15.00	$30.00	$53.00	$96.00	$190.00
IMI44	.44 MAG (Headstamped I.M.I.)	$ 15.00	$ 33.00	$ 60.00	$ 110.00	$ 218.00
IMI45	.45 ACP	$ 15.00	$ 27.00	$ 45.00	$ 85.00	$ 168.00
IMI41	.41 ACTION EXPRESS	$ 17.00	$ 34.00	$ 60.00	$110..00	$ 215.00
IMI50AE	.50 ACTION EXPRESS	$ 25.00	$ 60.00	$115.00	$ 217.00	$ 430.00
RIFLE BULLETS						
IMI22C62	.22 Cal 62gr FMJSCBT w/c (M855)(.224)		$ 26.00	$ 40.00	$ 68.00	$134.00
IMI22SC	.22 Cal 62 gr FMJBTw/c SUPER MATCH		$ 25.00	$ 35.00	$ 58.00	$ 114.00
IMI22C55	.22 Cal 55gr FMJBT w/c (M193) (.224)		$ 12.00	$ 20.00	$ 35.00	$ 68.00
IMI22C62	.22 Cal 62gr FMJBT w/c (.224)		$ 25.00	$ 35.00	$ 58.00	$ 114.00
IMI30C150	.30 Cal 150gr FMJBT w/c (.308)		$ 25.00	$ 45.00	$ 80.00	$ 159.00
IMI50C300H	50 Cal Action Express 300gr JHP (.500)		$ 49.00	$ 93.00	$ 180.00	$ 358.00
IMI50C300S	50 Cal Action Express 300gr JSP (.500)		$ 49.00	$ 93.00	$ 180.00	$ 358.00

Israel Military Industries LOADED AMMUNITION

S109 .223 AMMO (Green Tip)

This is original "GREEN TIP" STEEL CORE LOADED AMMO. MFG. 1996. Packed in 30 round military boxes. SHIPPING PREPAID # IMISS109

$ 91.00 / 240
$ 259.00 / 720
$ 399.00 / 1200

.50 BMG M33 LOADED AMMO

MATCH GRADE GFACTORY AMMO . PACKED 10 CARTRIDGES PER BOX.

$ 280.00 /100
$ 636.00 / 240
$ 2600 / 1000

WINCHESTER

POWDER

Type	Size	Price	Type	Size	Price
231	1 LB	138/ 10	WSF	1 LB	139/ 10
231	3 LB	215 / 6	WSF	3 LB	219 / 6
231	8 LB	345 / 4	WSF	8 LB	179 / 2
296	1 LB	143 / 10	540	1 LB	139 / 10
296	3 LB	225 / 6	540	3 LB	223 / 6
296	8 LB	365 / 4	540	8 LB	339 / 4
WSL	1 LB	139 / 10	571	1 LB	139 / 10
WSL	3 LB	219 / 6	571	3 LB	228 / 6
WSL	8 LB	179 / 2	571	8 LB	360 / 4
WST	1 LB	139 / 10	748	1 LB	149 / 10
WST	3 LB	219 / 6	748	8 LB	385 / 4
WST	8 LB	179 / 2	760	1 LB	149 / 10
			760	8 LB	385 / 4

Powder Prices include SHIPPING and HAZ. MAT. TAG CHARGE

Master Match Bullets

Accurate, brightly polished, & high quality. Prepaid Shipping

ITEM	250	500	1000	2000
9MM Bullets - .355" DIA				
9MM 115 GR FMJ	18.00	25.00	43.00	85.00
9MM 124 GR FMJ	18.00	25.00	44.00	86.00
9MM 125 GR JSP	18.00	25.00	44.00	86.00
9MM 135 GR Trun FMJ	18.00	29.00	48.00	94.00
9MM 135 GR FMJ	18.00	29.00	48.00	94.00
9MM 147 GR FMJ	18.00	31.00	51.00	100.00
38 / 357 Bullets - .357" DIA				
38 Cal 125 gr JHP	18.00	28.00	44.00	85.00
38 SUPER / 9MM Bullets - .356" DIA				
38 SUPER 115gr FMJ	18.00	25.00	44.00	86.00
38 SUPER 135gr FMJ	18.00	29.00	48.00	94.00
38 SUPER 135TC FMJ	18.00	29.00	48.00	94.00
38 SUPER 147gr FMJ	18.00	31.00	51.00	100.00
38 SUPER 147gr TC	18.00	31.00	51.00	100.00
45 ACP Bullets - .452" DIA				
45 CAL 230 gr FMJ	24.00	43.00	77.00	152.00
45 CAL 185 gr JHP	25.00	45.00	81.00	160.00
45 CAL 230 gr JHP	29.00	47.00	85.00	168.00

HODGDON 8 POUND KEG

H1000 H4198 H322
H4895 H4227 H4350
H4831 VARGET
$113.00 / 8 LB

HODGDON 8 POUND KEG

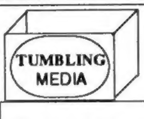
CLAYS	$ 105.00
H335, BLC-2	$ 110.00
HP-38	$ 105.00
H450	$ 110.00

Remington.

NICKEL Plated Rifle Brass

DESCRIPTION	100	250	500	1000
222 REM. Nickel Plated	20.00	43.00	76.00	145.00
223 REM. Nickel Plated	20.00	43.00	76.00	145.00
22-250 REM Nickel Plated	25.00	55.00	102.00	195.00
243 WIN Nickel Plated	26.00	58.00	150.00	202.00
25-06 REM Nickel Plated	30.00	69.00	130.00	252.00
270 WIN Nickel Plated	25.00	61.00	109.00	210.00
7MM-08 Nickel Plated	28.00	68.00	122.00	239.00
7MM RemMag Nickel	34.00	80.00	152.00	296.00
30-30 WIN Nickel Plated	21.00	47.00	86.00	163.00
30-06 SPRG Nickel Plated	27.00	61.00	110.00	213.00
300 WIN MAG Nickel	36.00	84.00	159.00	309.00
300 WBY Mag Nickel	43.00	102.00	195.00	383.00
308 WIN Nickel Plated	26.00	61.00	112.00	214.00
45-70 GOVT Nickel Plated	39.00	93.00	177.00	345.00

PRICES INCLUDE SHIPPING CHARGES.



Media prices do not include shipping.

	25 lb	50 lb
CORN COB	$ 15	$ 20
WALNUT HULL	$ 20	$ 35

HARD CAST BULLETS

Our cast bullets are truly **HARD CAST BULLETS!** They are #9 Saeco hard, triple lubed and do not stick together in the box. They are the best cast bullet available. PRICES PLUS SHIPPING!

DESCRIPTION	Wt / M	Price per 1000
.380 95 GR RN .356 Dia.	15 lbs	$ 24.00 / M +shipping
9MM 122 gr TSW .356 Dia.	19 lbs	$ 26.50 / M +shipping
9MM 145 gr LRN .356 Dia	22 lbs	$ 28.00 / M +shipping
38 cal158 gr SWC.357 Dia	24 lbs	$ 29.00 / M +shipping
40 cal 155 gr SWC .400 Dia	24 lbs	$ 29.00 / M +shipping
40 cal 170 gr TSW .400 Dia	26 lbs	$ 32.00 / M +shipping
45 cal 185 gr SWC.452 Dia	28 lbs	$ 33.00 / M +shipping
45 cal 200 gr SWC.452 Dia	30 lbs	$ 34.00 / M +shipping
45 cal 230 gr RN .452 Dia	35 lbs	$ 36.50 / M +shipping
44 cal 240 grSWC .430 Dia	36 lbs	$38.00 / M +shipping

ONCE-FIRED BRASS - PREPAID

PRICES INCLUDE SHIPPING CHARGES !!!

CALIBER	500	1000	3000	5000
38 Spec. - Commercial - Brass	20.00	38.00	111.00	175.00
9MM MILITARY	18.00	25.00	50.00	75.00
9MM - Commercial-brass	22.00	32.00	90.00	145.00
9MM - Commercial-nickel	22.00	36.00	99.00	155.00
40 S&W - ALL Commercial	35.00	52.00	150.00	245.00
.223 Rem. - Military	20.00	36.00	90.00	145.00

J. Dewey Mfg. Co., Inc.

NYLON COATED RODS

ITEM#	DESCRIPTION	PRICE
D17C11	.17 Cal. Airgun 11"	$ 19.00
D17C18	.17 Cal. Airgun-Rifle 18"	$ 21.00
D17C26	.17 Cal. Airgun-Rifle 26"	$ 21.00
D17C36	.17 Cal. Rifle 36"	$ 23.00
D22C12	.22-.26 Cal. Pistol 12"	$ 21.00
D22C17	.22-.26 Cal. Silhouette 17"	$ 22.00
D22C24	.22-.26 Cal. Rifle 24"	$ 22.00
D22C36	.22-.26 Cal. Rifle 36"	$ 23.00
D22C44	.22-.26 Cal. Rifle 44"	$ 23.00
D30C17	.27 & UP Silhouette	$ 22.00
D30C24	.27 & UP Rifle 24"	$ 22.00
D30C36	.27 & UP Rifle 36"	$ 23.00
D30C44	.27 & UP Rifle 44"	$ 23.00
D38C12	.27 & UP Pistol 12"	$ 21.00

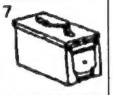
FREIGHT: 1-4 rods are plus freight PLUS $2.00 box charge for packing. 5 or more rods are shipped PREPAID with no box charge. All other Dewey products are prepaid with total $ 100.00 order. All rods come with applicable jags and or brush adapters.

PROTEKTOR MODEL

We stock a full line of these sandbags. Call us for your needs.

ITEM#	DESCRIPTION	Prepaid Price
PM1	SMALL OWL EAR FRONT BAG	$ 12.75
PM2	REGULAR OWL EAR FRONT BAG	12.75
PM3	WIDE OWL EAR FRONT BAG	12.75
PM4	SMALL OWL EAR STRADDLE BAG	16.75
PM5	REGULAR OWL EAR STRADDLE BAG	16.75
PM6	WIDE OWL EAR STRADDLE BAG	16.75
PM7	STANDARD FRONT BAG	16.75
PM8	SAUSAGE FRONT BAG	12.75
PM9	LARGE OWL EAR FRONT BAG	14.50
PM10	LARGE SAUSAGE FRONT BAG	14.50
PM11	HALF MOON FRONT BAG	14.50

Military .50 Cal Ammo Can



They measure 6" x 11 1/4" x 7 1/4" and are used but in excellent shape. 7 lb ea. Shipping charges are extra!! ITEM # AC50

Regular Price	Sale Price
~~$ 6.00 / 1~~	$ 3.00 ea.
~~$ 30.00 / 6~~	$ 15.00 / 6

ONCE-FIRED BRASS - PREPAID

9MM NICKEL PLATED
Once-Fired Brass

$ 22.00 / 500 $ 36.00 /1000
$ 99.00 / 3000 $ 155.00 /5000

Prepaid Shipping.

Accurate Smokeless Powders

DATA POWDER A2200

Suitable for small cases such as .223 to 7.62 x 39. Not for .308.

$ 68.00 / 8 lb Keg
$ 230.00 / 4 - 8 lb Kegs

Prices include shipping, haz mat fee.

Please ask for our FREE CATALOG. Low Prices and Great Service.

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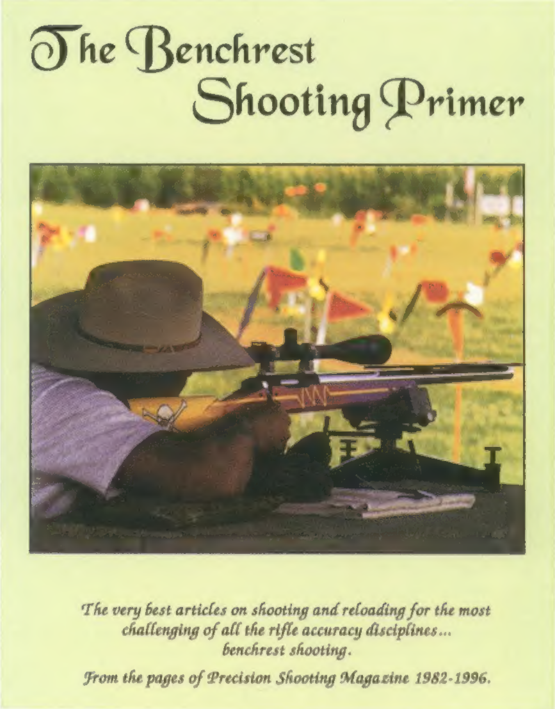
Prepaid Shipping.

THE BENCHREST SHOOTING PRIMER

It's 420 pages in size, and 182 separate articles, all on the sole topic of "how to" benchrest shooting and reloading for benchrest shooting. The very best articles on the topic from the first fifteen years of Dave Brennan's editorship of *Precision Shooting* magazine. Here are articles from a number of Benchrest Hall of Fame members, as well as leading accuracy gunsmiths, barrel makers and bullet makers. And including at least a dozen "Question and Answer" type articles... a perennial favorite with our readers... since differences of opinion were frequently aired with a "damn the torpedoes" attitude.

Benchrest shooting has been responsible for many of the accuracy developments of the last half of the 20th century, and many of the Hall of Fame shooters and Benchrest Shooter of the Year winners appear in these pages, giving their let-the-chips-fall-where-they-may views on everything from shooting styles to equipment selection. Such diverse matters as case neck turning, seating depth selection, using wind flags and shooting in both wind and mirage are discussed in depth in these pages... as is the selection of winning benchrest equipment. While our opinion on the matter may be just a little prejudiced... this publication is a got-to-have for any firearms library that gives attention to the topic of rifle accuracy.

ORDER NOW: $24.95, plus shipping and handling.



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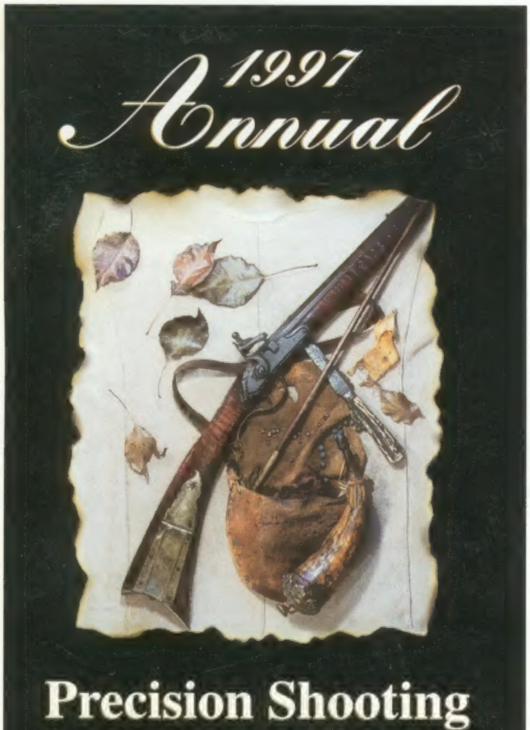
The very best articles on shooting and reloading for the most challenging of all the rifle accuracy disciplines... benchrest shooting.

From the pages of Precision Shooting Magazine 1982-1996.

1997 PRECISION SHOOTING ANNUAL



1997 Annual

Precision Shooting

The fifth issue in our series of annuals which we've heard described as... "Think of *Gun Digest...* but dealing only with rifles".

Many familiar names from our stable of writers have returned, names that you're familiar with, and comfortable with. For a bit of light-hearted reading, to take you away from the trevails and unpleasantness of the day... Roy Baumgardner recalls "*Another Shooting at Grandma's*" (We note with surprise that *anyone* survived the wild and woolly days at that place)... and not to be outdone at this Raconteur business, Joe Rychenik muses on "*A Tale of Two Rifles*" (The editor notes that he would not want to get between Rychenik and Baumgardner in a yarn-spinning session). Jack Brogden recalls his early days of shooting in the United Kingdom with "*Those Were The Days, My Friend*", one of the best pieces of firearms writing to cross our desk in many a moon. Want to move on to technical matters, you say? Hmm... how about "*Bore Capacity Revisited*", by John Dustin? Or "*How Case Head Condition Affects Bullet Behavior*", by Norman Johnson? Or how about Randolph Constantine's scholarly "*The Incremental Load Development Method*"... a major new work in its field... and one that highpower, long-range and varmint shooters will find worth its weight in gold? Our highpower friends will both enjoy and benefit from "*A Highpower Odyssey*", by Robert Metaxas. For a bit of nostalgia, Jim Foral takes us back in time, to spend "*An Afternoon With Elmer Keith*". And for history buffs (and we have a large number of them among our readers), Joe Roxby has penned "*Lewis Wetzel: Separating The Man From The Myth*", for those of you caught up in the Wetzel aura in our September 1997 issue.

Some 20 articles, 500 pages, and your annual opportunity to "pig out" on rifle lore.

ORDER NOW: $26.95 soft-cover, $34.95 hard-cover, plus shipping & handling.

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